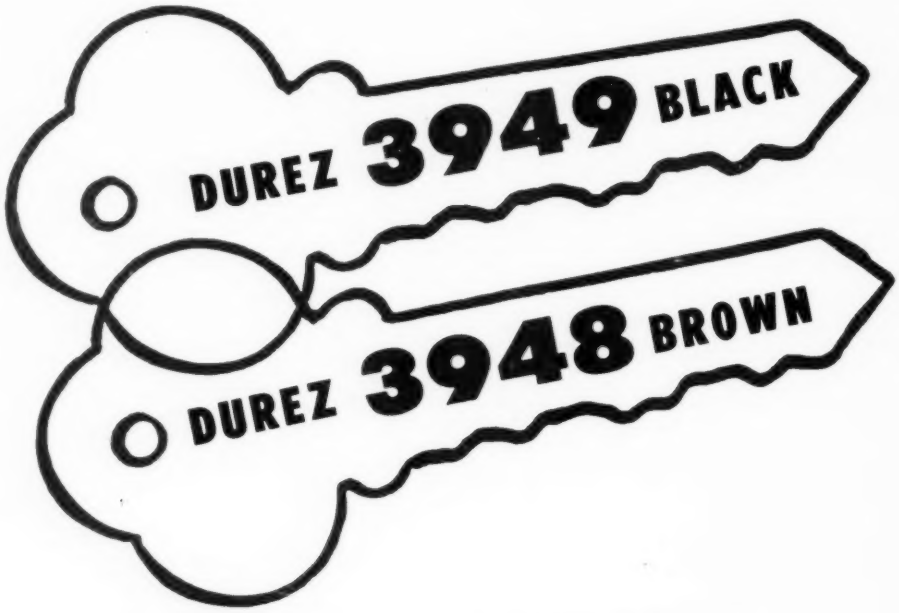
MODERN PLASTICS

AUGUST 1952



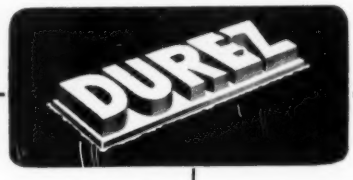
they open the way to closure profits

In the highly competitive closure field where "fast cure" is another way of saying "profits," Durez offers you the greatest speed of cure available in phenolic closure materials. But speed is not everything. Top performance helps you build profits, too.

The molding characteristics of 3949 Black and 3948 Brown compounds enable you to turn out top-quality closures on any type of completely automatic molding machine. You can satisfy the most rigid requirements with their tensile strength (7,000 p. s. i. min.), non-bleed, and minimum odor properties.

Durez closure materials, developed by specialists who pioneered in this field, have been the stand-out preference of molders everywhere for 25 years. For caps of any shape or size, and for small parts where electrical requirements are not critical and production speed is essential, specify and profit with Durez 3949 and 3948.

Sample and data will gladly be sent. Write to Durez Plastics & Chemicals, Inc., 1208 Walck Road, North Tonawanda, N. Y.



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MODERN PLASTICS*

VOLUME 29 AUGUST 1952 NUMBER 12

CONTENTS

Modern Plastics, published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the Act of March 3, 1879.

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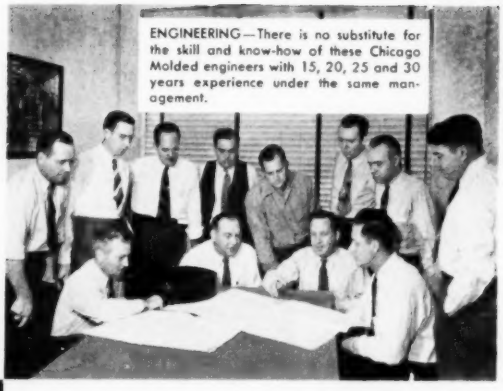
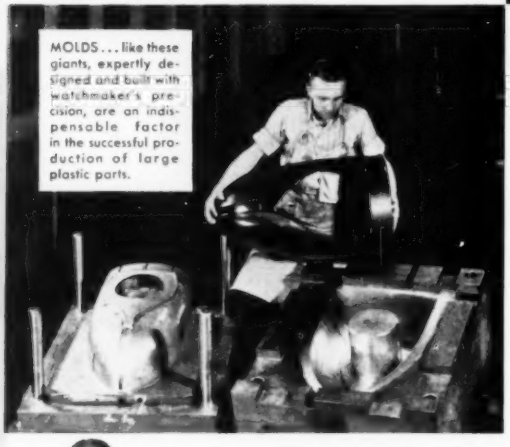
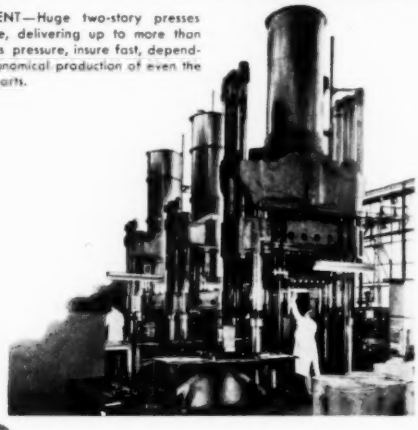


ENGINEERING—There is no substitute for the skill and know-how of these Chicago Molded engineers with 15, 20, 25 and 30 years experience under the same management.



MOLDS . . . like these giants, expertly designed and built with watchmaker's precision, are an indispensable factor in the successful production of large plastic parts.



EQUIPMENT—Huge two-story presses like these, delivering up to more than 1500 tons pressure, insure fast, dependable, economical production of even the largest parts.

EXPERIENCE—Since the 1920's, Chicago Molded has pioneered the molding of large units. These are typical of parts produced for some of the biggest names in industry.

Plus . . . the ability to analyze and understand your needs and interpret them correctly . . . the seasoned judgment to avoid misapplications . . . the faculty for getting into production without undue delay and to plan each operation so as to achieve maximum efficiency and economy . . . the knowledge of materials and techniques that comes only with years of solving just about every conceivable plastics application.

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EDITORIAL

Plastics' Proving Ground—the Automobile

To those concerned with future markets for plastics and the expansion of present markets for plastics, our lead article this month should be of great interest. This is probably the most comprehensive report yet made on the use of plastics in automobiles.

Because of the unit cost of its products, because of its terrific tooling expense, and because of the necessity of maintaining huge parts inventories, the automotive industry is most conservative in matters of change.

Yet this article presents a picture of remarkable progress in automotive applications of a great variety of plastics. It is almost impossible to make a general estimate of the increased use of plastics in automobiles volume-wise; but taking a medium priced passenger car as a gage, and adding the weights of all plastics parts together, a total of about 15 lb. is reached. This compares with a 1947 figure of 9 lb. per car, and a 1941 figure of 7½ lb. per car. In a decade, the per-unit use of plastics in the automotive industry has doubled.

As plastics, properly applied, prove themselves satisfactory in one new automobile component after another, the engineer's and designer's resistance to plastics is lowered. And as reports going back from satisfied automobile owners through sales departments and service departments continue to indicate public pleasure at the durability and other properties of the plastics parts, the automotive industry is encouraged to use more plastics. Furthermore, as production departments find that plastics parts give them lower breakage losses, lower transportation costs, and faster assembly operations, the economy of plastics is favorably shown.

If there is any trend of general significance in passenger automobile design today, it is the trend toward the combination truck and sedan called a station wagon, a ranch wagon, or a suburban wagon. The current phase of decentralization of industry with attendant new suburban home construction, has made this utility type of car almost a necessity to many families, since few can afford to own both a truck and a passenger car.

These utility vehicles are "naturals" for more plastics. They are the perfect place for vinyl upholstery, but not pile fabrics. They are the perfect place for reinforced plastic bodies, but not wood. They are the perfect place for sheet copolymer door liners and seat backs. They're the perfect place for all materials which must stand up to abrasion, impact, heat, cold, and chemical attack.

The story of the automotive industry's present vastly accelerated study of plastics will only come out in bits and pieces as the study results in new applications. But it is a very safe bet that within the next five years, this industry will again double its per unit use of plastics, which means that by 1957 the automotive industry should consume more than a quarter of a billion pounds of plastics per year.

This progress will mean a lot to the plastics industry. It will mean even more because of the conservatism of the automotive industry, because plastics components in automobiles are given such thorough testing before being applied to production models, and because plastics in automobiles have to take more continuous punishment and more kinds of punishment than in most other consumer products.

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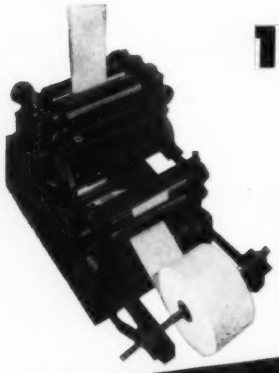
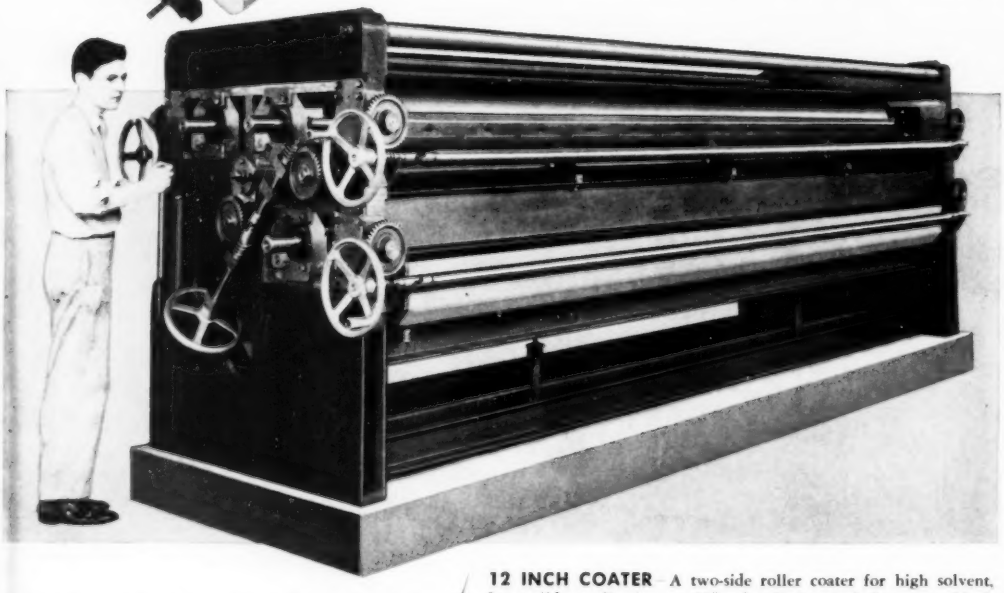


12 INCHES ... or 12 Feet

Whatever the size or type of coater you require, see IOI to be sure of advanced engineering, sound basic principles, rugged construction



COATING MACHINES designed and built by IOI cover a wide variety of types and sizes for all kinds of web materials, coating solutions and methods of application. IOI's range extends from precision units for rotogravure coating of paper, to versatile combination units for roller, knife or flow coating a wide variety of solutions on paper, foil, film or any coatable web. The units illustrated are typical of the entire line in their advanced design and rugged construction.

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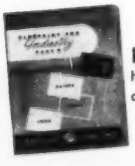

Do you want to cut production costs? IOI's advanced engineering on sound basic principles can help you if you will outline for us your specific production problem. Write for "Blueprint for Industry, Part V, Coating and Handling Equipment for Textiles, Papers, Films and Foils" and "The Handling of Webs and Monofilaments."

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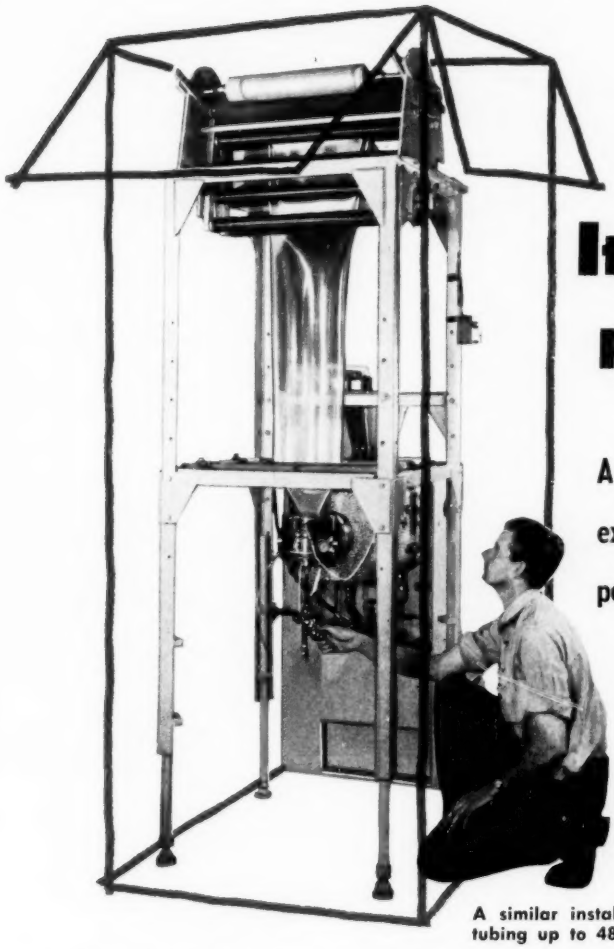

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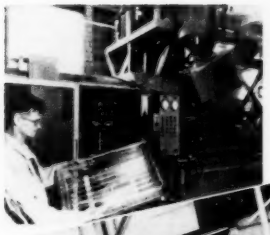

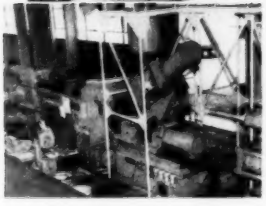

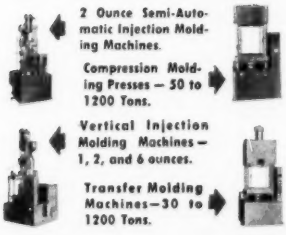

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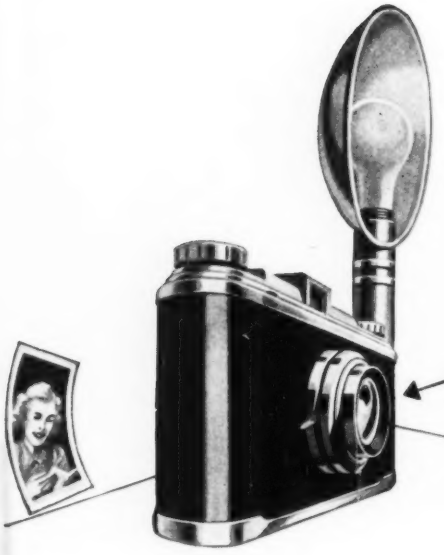

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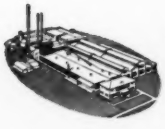

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BRANCH SALES OFFICES: New York, *Lexington 2-6677* • Rochester, *Hillside 4352* • Chicago, *Harrison 7-5473* • Detroit, *Trinity 3-7050* • Philadelphia, *Granite 2-7484* • Dallas, *Logan 1970* • Los Angeles, *Richmond 7-5384* • St. Louis, *Delmar 9577* • Toronto, *Riverdale 3511* • **EXPORT OFFICE:** 89 Broad Street, New York City, *Bowling Green 9-7751.*

Notes on a Calendar Pad:

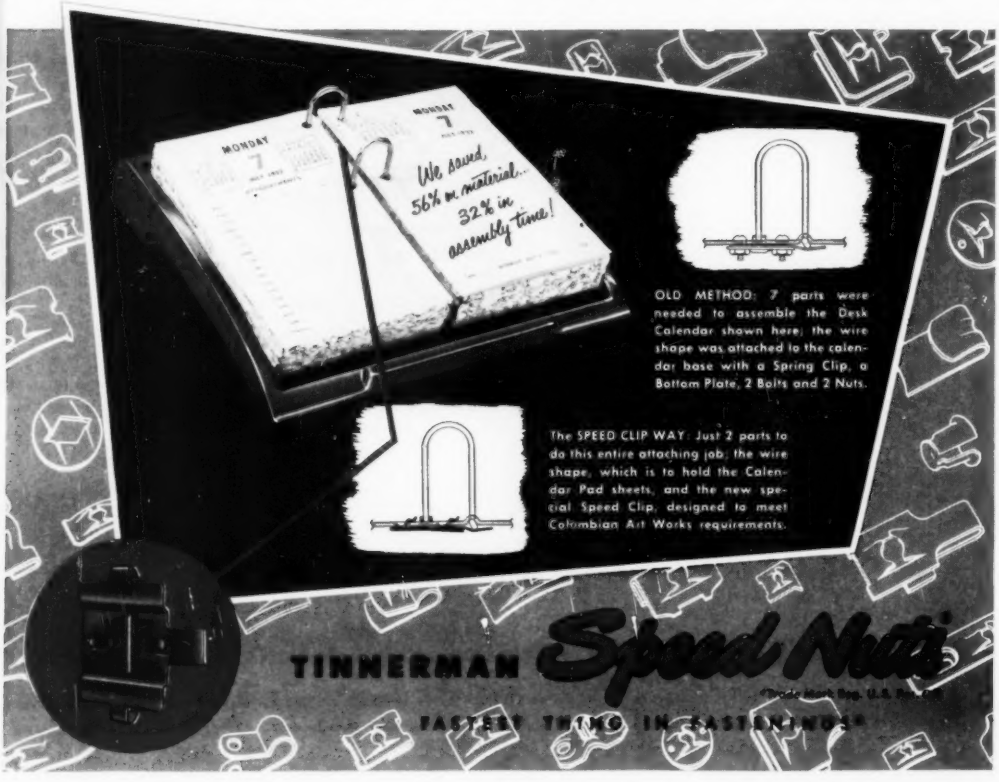
"We saved 56% on material... 32% in assembly time!"

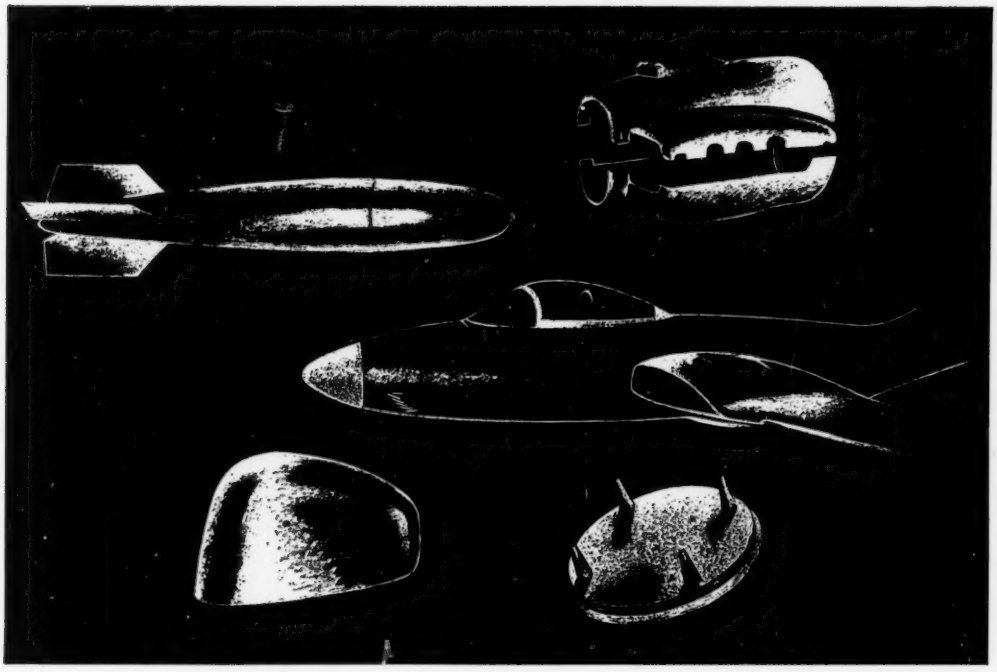
Desk Calendar Manufacturer makes "up-to-date" Savings by switching to Tinnerman Speed Clips

Here's how Columbian Art Works, of Milwaukee, Wisconsin, makers of quality desk calendars, recently checked their own production methods and picked up this amazing time and material savings! For many years they used 6 parts, plus a wire arch brace, to assemble and fasten one of their popular calendar pad models. Today . . . the Speed Clip way, this entire operation is done with 2 parts—the wire shape, and one multiple-function, special Speed Clip. The result is a saving of 32% in assembly time and 56% in material costs!

Savings like these are worth thinking about! Before too many sheets are torn from your calendar pad, make a date with your Tinnerman representative for expert advice on fastener engineering. There may be a "SAVINGS STORY" in your fastening assemblies. Meanwhile, write for a copy of the FREE booklet: "SAVINGS STORIES", TINNERMAN PRODUCTS, INC., Dept. 12, Box 6688, Cleveland 1, O. *In Canada:* Dominion Fasteners, Ltd., Hamilton, Ontario. *In Great Britain:* Simmonds Aerocessories Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S.A., 7 rue Henri Barbusse, Levallois (Seine), France.

Whatever you make—from Calendar Pads to Clothes Dryers—think first of TINNERMAN for better Fastening Engineering.





A SIGNIFICANT ADVANCE IN AIRCRAFT ENGINEERING...

POLYESTER REINFORCED PLASTICS—

Aircraft designers have found a new way to improve performance and reduce weight in many components formerly made of metal, thereby releasing metals for jobs only metals can do. They're specifying reinforced plastics made of glass fiber cloth or mat, bonded with BAKELITE Polyester Resins.

These new plastics have been employed for a variety of aircraft and marine applications, where a combination of great strength and low weight is necessary, and ease of fabrication is important. Fin tips, radomes, air intakes, flooring, and duct work are on the growing list of their applications.

Several different BAKELITE Polyester Resins, as well as grades of glass fiber cloth, are available to meet widely varying needs. For example, one type of reinforced plastic is produced from Owens-Corning "Fiberglas" cloth 181-136, laminated with BAKELITE Polyester Resin BRSQ-193, plus 10% monomeric styrene. The resulting laminate, when tested at standard conditions under U. S. Air Force Specification No. 12049, provides these physical properties:

Ultimate Strength, Flexural, Flatwise ..... 63,400 psi
Ultimate Strength, Tensile . 47,400 psi
Ultimate Strength, Compressive, Edgewise . 39,700 psi
Impact Strength, Edgewise, Notched Izod, in. notch . 20.53 ft. lb.

All of these values greatly exceed the requirements of the specification. Yet, the specific gravity of this reinforced plastic, which contains about 36 to 38 per cent resin, is only 1.8.

Reinforced plastics made with BAKELITE Polyester Resins have excellent electrical characteristics, including electrical "transparency" for radar housings. They are all within the Air Force flammability requirements. They are also highly resistant to such chemicals as hydraulic oil, isopropanol, ethylene glycol, and fluid hydrocarbon, Type II. Details on these and other valuable properties of reinforced plastics are included in booklet H-16, "BAKELITE Polyester Resins for Reinforced Plastics." Write Dept. EC-13.

BAKELITE
TRADE-MARK
POLYESTER RESINS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42 Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

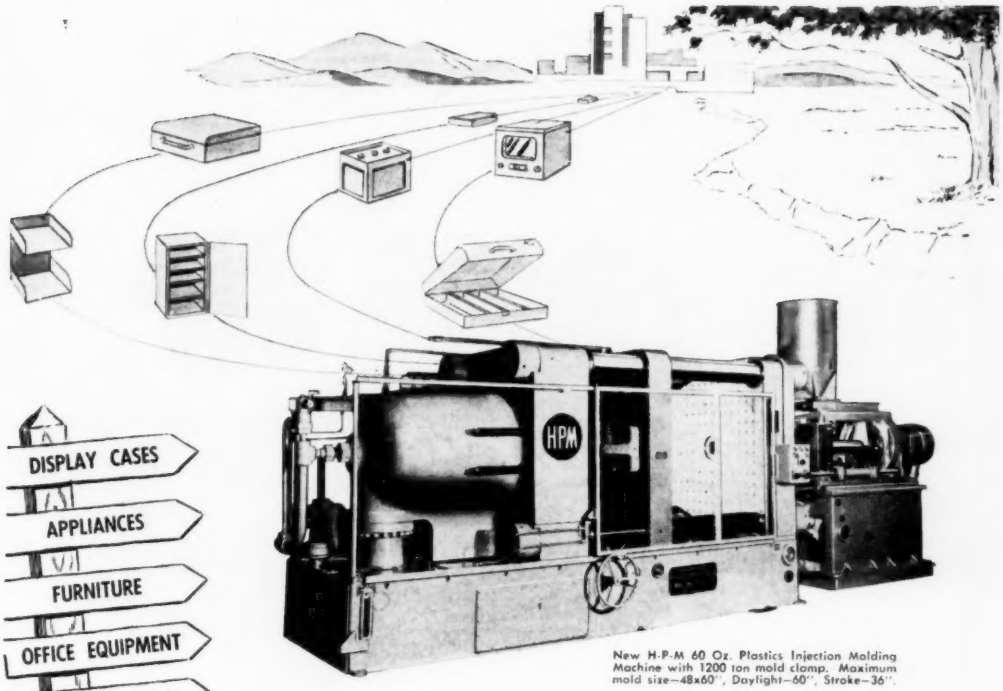
PLASTICS FOR INDUSTRY

CRUVER is proud to again have a part in Philco's 1952 Refrigerator program.

Illustrated above are handle inserts, decorated by CRUVER's "Bas-Releef" process. In addition to our decorative facilities for nameplates, escutcheons, etc., we have press capacity up to 60-ounces for large plastic components such as evaporator doors, trays, breaker strips, etc. These large pieces can also be decorated in standard lacquers and bright finish. Let CRUVER do the entire job for you—castings, painting, and assembly.

CRUVER
Manufacturing Company
2460 W. JACKSON BLVD. CHICAGO 12, ILLINOIS
MOLDING • FABRICATING • LAMINATING • FINISHING
PIONEERS IN PLASTICS SINCE 1896
"BAS RELEEF" DECORATING • ASSEMBLY • SPRAYING

Branch Offices: DAYTON • DETROIT • MINNEAPOLIS • NEW YORK • PHILADELPHIA • SYRACUSE



New H-P-M 60 Oz. Plastics Injection Molding Machine with 1200 ton mold clamp. Maximum mold size—48x60", Daylight—60", Stroke—36".

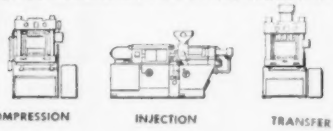
all signs point to...
NEW MARKETS with *H-P-M "60s"*

The new markets for big plastics parts have just been scratched! You don't need a refrigerator or television contract in your back pocket to warrant a "big" machine. A wide variety of consumer items such as store display cases, appliances, furniture, office equipment, file trays, battery boxes . . . plus hundreds of other applications and new products are being developed today by molders of vision.

Prominent molders already capitalizing on the outstanding performance of H-P-M 60s are—General American, Santay, General Electric, Cruver, Victory, Federal Tool, Consolidated Molded Products, Foster-Grant, Ideal and many others. H-P-M offers you prompt delivery from stock lots. Write for Bulletin 5204 describing H-P-M Injection Machines . . . 9, 16, 32, 48 and 60 ounce.

HPM

PLASTICS MACHINES FOR EVERY MOLDING JOB



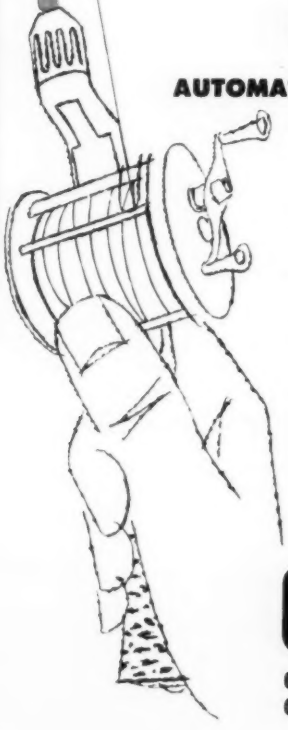
COMPRESSION INJECTION TRANSFER

THE HYDRAULIC PRESS MFG. CO.

1010 MARION RD., MOUNT GILEAD, OHIO, U.S.A.

Deliveries on standard CINCINNATI FILMATIC No. 2 Centerless Grinders (below) are better than you might imagine. They are versatile precision grinding machines for small quantities or large lots. You may obtain complete data by writing for catalog No. G-611.

Glass casting rod, centerless ground by the thrufeed method at a traverse rate of about 185 in. per min. Stock removal, variable, 0 to 7/32". Machine: CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped with Taper Grinding Attachment.



cincinnati filmatic centerless

AUTOMATICALLY GRINDS TAPER ON GLASS CASTING RODS

Here's a new method that will reduce costs for any shop producing long tapered parts. Glass casting rods, desired by most fishermen because of their extreme flexibility and high strength, are now *centerless ground* by the thrufeed method. To perform this operation, a CINCINNATI FILMATIC No. 2 Centerless Grinder is equipped with a taper grinding attachment. The work is mechanically pushed between the wheels at a rate of about 185 in. per min. As feeding progresses, the regulating wheel unit, through a cam and hydraulic cylinder arrangement, increases the distance between the wheels. Exceptionally accurate tapers are produced within ± .001" in 3" increments of length. By changing the cams and/or the change gear ratio, almost any desired taper can be thrufeed centerless ground. ¶ This ingenious centerless taper attachment, coupled with the advantages offered by CINCINNATI FILMATIC Centerless Grinders, give you a combination that can't be beat for low-cost accurate performance. One feature alone, FILMATIC grinding wheel spindle bearings, is sufficient reason to choose Cincinnati. And as always, our Application Engineers will be glad to help you with your precision grinding problems.

CINCINNATI GRINDERS INCORPORATED • CINCINNATI 9, OHIO

CINCINNATI FILMATIC

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Manufacturers of phenolic thermosetting molding compounds and phenolic synthetic resins for the electrical, transportation, home appliance, paper and pulp, protective coating and foundry industries.

Dry granular phenolic thermosetting molding compounds are produced in blacks, browns, mottles and colors in general purpose, heat-resisting and medium impact grades. Special purpose molding compounds are produced to fulfill special molding requirements.

Synthetic resins are produced in dry, lump and finely ground particle size or in solution adaptable to customer's requirements. Technical service is extended and inquiries are invited.

PLEN ENOLICS

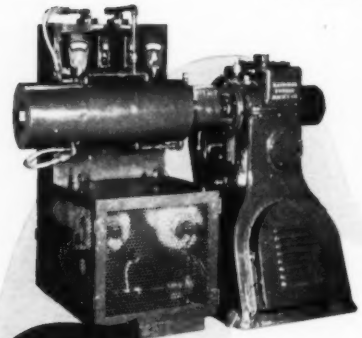
FOR BETTER
PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

NRM GAVE YOU THE FIRST

. . . GIVES YOU THE LATEST



In 1940, NRM gave you the first commercially available extruder specifically designed for thermoplastics.

In 1952, NRM gives you its newest, oil heated, thermoplastics extruder — the 2½" Model 50.

in Extruders for Thermoplastics

FOR both the first and last word in plastics extruders, you can't beat NRM. Years ago, NRM was 'way out in front with the first commercially available extruder especially designed for thermoplastics. Today, they're still out in front with the very latest in plastics extruder design and construction.

NRM's engineers have always led the field in the development of better plastics extrusion equipment. They've kept pace with the fast-moving plastics industry. They developed new equipment for new products — new techniques for new applications. Their long list of "firsts" in plastics extruder design and construction is indeed impressive.

But such "firsts" as the first commercially available plastics extruder, the first electrically heated extruder, the "torpedo-type" feed screw, "Balanced Heat Control," and the quick opening front flange and die assembly are more than just impressive. To you, these achievements mean dollars and cents. They mean money made and money saved in the production of better extrusions at lower costs.

Look to NRM for the latest and the significant advances in plastics extrusion equipment. Let NRM's extrusion experts apply their long experience in the pioneering of rubber and plastics processing equipment to your particular production problems.

NATIONAL RUBBER MACHINERY COMPANY NRM 2098

General Offices & Engineering Laboratories: Akron 8, Ohio

East: 384 Getty Ave., Clifton, N. J.

West: S. M. Kipp, Box 441, Pasadena 18, Cal.

Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

Creative Engineering

no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

That's what one of the thousands of pleased users says about his CRUCIBLE TOOL STEEL SELECTOR, the new, simple, handy method of picking the right steel, *right* from the start. Since Crucible announced this Selector two years ago, thousands of tool steel users have received their Selectors . . . and here's what some of them say —

"Handiest selector I've ever seen!"

"Saves me time and headaches"

"It's so logical—you begin with the application".

You can be sure the answer you get with your Crucible Tool Steel Selector will be just right in every case, for this Selector covers 22 tool steels which fit 98% of all tool steel applications. And when—with a flip of the round dial—you get the answer, you'll get the steel FAST, too, because all the tool steels on the Selector are right in stock, in all our 26 conveniently-located warehouses.

This Selector is bound to be a big help to you—so write for yours today. There is no obligation whatsoever. Just fill in the coupon and mail now . . . before you turn this page and forget! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, New York.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!

Crucible Steel Company of America
Dept. MO, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my free CRUCIBLE TOOL STEEL SELECTOR!

Name_____ **Title**_____

Company_____

Street_____

City_____ **State**_____

CRUCIBLE first name in special purpose steels

TOOL STEELS

52 years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

Good Finishing BEGINS

with Waterproof Cloth Abrasive Belts by CARBORUNDUM

You end up with a good finish when you *begin* with the belt especially developed by CARBORUNDUM for wet sanding of plastics and other ductile materials subject to plastic flow.

Its "five-star" features are designed to give you better finishing, in higher volume, at lower cost—the very results now being enjoyed by hundreds of plastic molders, coast to coast.

Run a trial on Waterproof Cloth Belts by CARBORUNDUM. We're confident you'll become a confirmed user. Today, call the CARBORUNDUM or distributor salesman.

- **Smooth-running splices — no "splice throb" to cause breakage**
- **Pre-stretched resin-filled cloth backing—high resistance to "wet-stretch" — less down-time for tension adjusting**
- **Clean, fast, cool cutting action—pre-buff finishes in record time**
- **Hard, sharp silicon carbide grain—high, continuous cutting rate**
- **Long, wear-resistant belt life**

OTHER COST-CUTTERS for custom molders are available from CARBORUNDUM. For example: the Vonnegut Brush-Backed Sander Head, designed specifically for finishing contours, curves and other irregular plastic surfaces. Cushioned wiping action generates a satin finish, readily buffed out. Effectively blends surface irregularities. Cool, clean cutting produces a finer, more uniform finish with less operator effort. Ask the CARBORUNDUM representative for details, or write Dept. MP 82-51R.

Only CARBORUNDUM

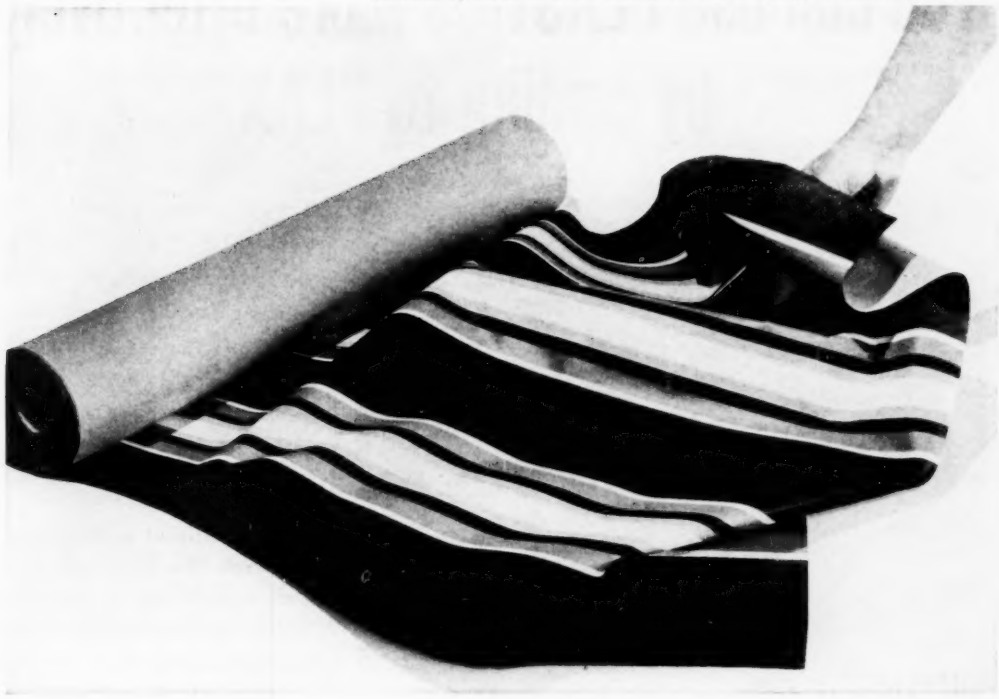
TRADE MARK

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N.Y.

offers ALL abrasive products ...to give you the proper ONE

82-51

Soft hand and casual drape characterize this PLIOVIC *coated fabric manufactured by the Graniteville Manufacturing Company, Graniteville, S. C.*



BETTER TEXTILE COATINGS—

when your vinyl dispersions are made with PLIOVIC

TEXTILE manufacturers everywhere are relying on PLIOVIC – Goodyear's vinyl for use either in organosol, plastisol or latex dispersions. Such coatings when used on textile materials have these outstanding advantages:

1. Lower fusing temperatures 2. Less discoloration 3. Higher gloss 4. Greater clarity 5. Lower water sensitivity

PLIOVIC gives you production advantages, too. Fusing temperatures are from 25°-50° lower—protection against scorch and damage to base fabrics. You need less costly plasticizer with PLIOVIC—and can disperse the resin in less time using standard equipment.

If you have a textile coating problem—or want assistance in developing new finishes and products, it will pay you to investigate PLIOVIC. Ask a Goodyear Chemical Division representative for details, or write:

Goodyear, Chemical Division, Akron 16, Ohio

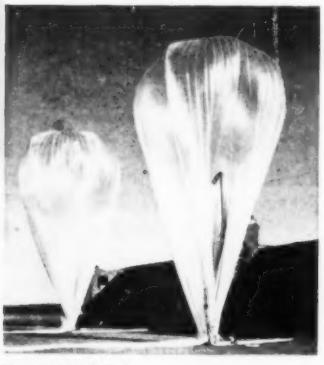
CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Pliolite, Pliovic–T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

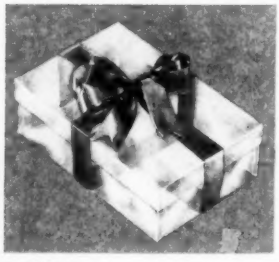
Use Proved Products — CHEMIGUM · PLIOBOND · PLIOLITE · PLIOVIC · WING-CHEMICALS — The Finest Chemicals for Industry

You can use PLASTICS more effectively by coming to PLAX

BOTTLES New 6½ and 13-gallon Plax carboy bottles solve problem of handling and shipping industrial chemicals with complete safety — a Plax origination.



BALLOONS High flying weather balloons use specially made Plaxpak polyethylene film—another Plax research triumph to meet exceptional product requirements.



BOXES These can be formed of Polyflex sheet without adhesives or heat sealing. This oriented polystyrene sheet is brilliantly clear, low in cost. It's another unique Plax product.

If it's a packaging problem, the unbreakable Plaxpak® polyethylene bottle may have the answer. Or it might be Polyflex, our crystal clear polystyrene sheet that's being used for everything from greeting cards to battery strips.

If it's functional or decorative, our thermoplastics sheets, rods, film or tubing may hold the key. We can help you select the right material and the best form for most economical production.

If it's a special problem, we offer you the assistance of our research and development facilities – and a background of broad experience in handling government and private industrial contracts.

PLEASE WRITE FOR CATALOG, DESCRIBING OUR PRODUCTS AND SERVICES

PLAX CORPORATION Subsidiary of Emhart Mfg. Co., HARTFORD 1, CONN.
In Canada, Plax Canada, Ltd., Toronto — District Sales Offices: New York, Chicago and other principal cities.
Plax® blow molded products made under U.S. Pats. 2128239, 2175053, 2175054, 2230188, 2230190, 2260750, 2283753, 2349176, 2349177, 2349178

PLAX FOR PLASTICS
NOT SUBSTITUTES - IMPROVEMENTS

DE MATTIA MOLDING EQUIPMENT

FOR IMPROVED PRODUCTION IN THE MODERN MOLDING PLANT — De Mattia molding presses and granulators — are world famous for fine performance and sureness of operation. Rugged De Mattia construction refinements assure long, continuous service.

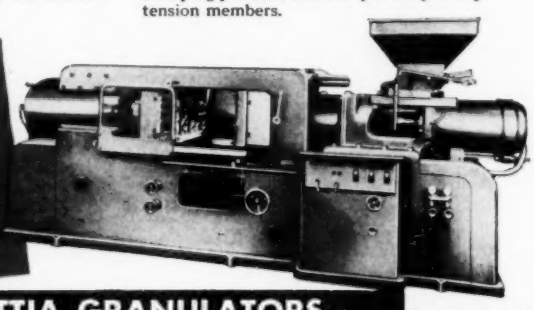
DE MATTIA MOLDING PRESSES

DE MATTIA 4 OUNCE VERTICAL

• A high efficiency, all hydraulic De Mattia Injection Molding Press featuring smooth fluid power for both injection and mold clamping operations. Design permits conversion for both compression and transfer work by use of a few low cost additions.

DE MATTIA 12 OUNCE HORIZONTAL

• The De Mattia Model C-1 Injection Molding Press combines the latest design advantages with the ultimate in molding performance. Features uniform hydraulic pressure on entire die face, high mold clamping pressure and exceptionally heavy tension members.

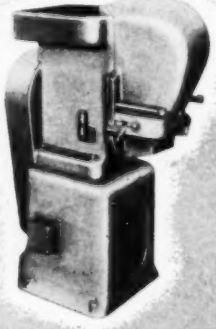


DE MATTIA GRANULATORS

DE MATTIA GRANULATOR No. 1

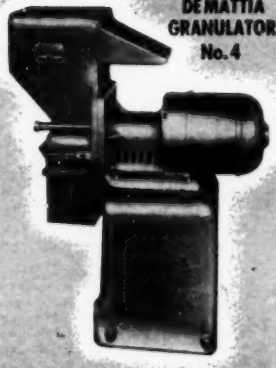
A simple, rugged and highly efficient granulator. Processes 200 lbs. per hour. Floor space required — 32" x 44"; net weight with motor — 600 lbs. approx. Features high grade roller bearings with positive seal.

DE MATTIA GRANULATOR No. 3



Salvages large chunks from heating cylinder, nozzle accumulations and tough molded pieces. Floor space — 32" x 18" x 45" high; net weight including motor 750 lbs. Heat treated alloys steel rotor.

DE MATTIA GRANULATOR No. 4



Especially recommended for installation along side the molding press. Available with or without base. Overall dimensions — 34" long, 12" wide, 23½" high (from bench). Hopper opening — 9" x 4½"; net weight 375 lbs.

New York Sales Office: 50 Church St.
Cable Address: Bromach, New York
Midwestern Representative: E. Maywald
189 West Madison St., Chicago 2, Illinois

DE MATTIA MACHINE and TOOL CO.

CLIFTON, NEW JERSEY

MOLDING PRESSES • GRANULATORS • MOLD MAKING

ZENITH "on the nose" in the Boeing YB-52

Equipped with eight of the world's most powerful jet engines, the giant YB-52 Boeing Stratofortress bomber is one of the most formidable fighting machines ever to take the air. Contributing to its strength are the fiberglas* reinforced plastic nose parts produced by Zenith—engineered to *perform*, built to withstand the terrific stresses of superjet speed. That's why both aircraft manufacturers and the U.S.A.F. consistently rely on Zenith parts.

For specific information and cooperation in both the civilian and military fields, consult our Engineering Division.

ZENITH PLASTICS CO. **gardena, calif.**

*t.m. reg.

STURTEVANT DUSTLESS BLENDERS

Thoroughly Blend Substances into an Inseparable Mass

The 4-Way Mixing Action of the Sturtevant Dustless Blenders thoroughly mixes two or more substances into an inseparable whole . . . every part of which is the same analysis. Single receiving and discharging opening insures tight sealing during mixing process. "Open-door" accessibility permits thorough cleaning. The fast, accurate mixing operation increases output . . . cuts mixing costs. Available in many sizes with mixing capacities from ¼ ton to 75 tons per hour. Write for information and catalog.

Receiving — The ingredients to be mixed enter the mixing chamber of drums through a chute. Note scoops which carry up and dump the ingredients as drum rotates assuring a more uniform mix.

Discharging — Throwing a lever closes the inlet and mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

The Sturtevant Mill Company

110 Clayton Street, Boston 22, Massachusetts

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

MUEHLSTEIN

specialists in *Reprocessed* plastics

If you use reprocessed plastics, or sell your plastic scrap or have it reprocessed on a contract basis—you can rely on MUEHLSTEIN for superior service, quality and technical "know-how."

MUEHLSTEIN specializes in reprocessed plastics. Their technical staff is at your service.

Further information and samples on request.

all types of virgin and scrap THERMOPLASTICS bought and sold

H. MUEHLSTEIN & CO. —INC.—

60 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis

Announcing

a medium priced line of HYDRAULIC PRESSES especially designed for molding

REINFORCED PLASTICS

● The new EEMCO heavy-duty, double acting reinforced plastics molding presses are carefully designed by expert engineers for smooth and efficient operation. They are made of the best materials and accurately built and tested by experienced workmen. Each part of the EEMCO PRESS is designed with a high factor of safety. An unusually strong, rigid press is thereby produced which has maximum strength and rigidity and minimum deflection and is capable of withstanding the severe service demanded by modern manufacturing methods.

The presses are built to furnish fast closing which reduces the over-all time of the operation cycle. They are ideal for molding all types of reinforced plastics whether it be flat sheets or large and bulky preforms. Developed in close cooperation with one of America's leading reinforced plastics molders these presses are made in the following standard sizes with a working area of 37″ x 55″, 47″ x 41″, 26″ x 42″, 32″ x 36″, and 44″ x 76″. Other sizes made to suit customer's requirements.

EEMCO ALSO OFFERS A COMPLETE SERVICE TO THE REINFORCED PLASTICS MOLDER

● It will pay you to investigate EEMCO's complete service which offers help in all angles of the production of reinforced plastics molding. Whether your needs are one press or a complete installation of presses (with or without pumps and controls) consult EEMCO and get the benefit of their experienced and expert help and advice in this comparatively new field of plastics molding.

Write or wire today for quotations and delivery dates

EEMCO

MILLS • CRACKERS
WASHERS • REFINERS
• • •
HYDRAULIC PRESSES
compression • transfer
reinforced plastics
• • •
Laboratory MILLS & PRESSES

ERIE ENGINE & MFG. CO.
12th St., & East Ave., ERIE, PA.

. . . with Plasticizers made by a Basic Producer

You're ahead from the start in your plastics formulations when you call on Pittsburgh Coke & Chemical for your plasticizers. For as a *basic* producer, we can offer you three important benefits: (1) Consistent uniform plasticizer quality —regardless of whether you buy in single drum lots or by the carload. (2) A broad family of plasticizers from a single, *basic* source of supply. (3) Fast, efficient shipments, backed up by dependable, continuing supplies. So when you're specifying plasticizers, get the details on PX Plasticizers *first.* You'll find it pays, *in every way,* to buy plasticizers from a basic producer. ● Don't hesitate to write or call for samples, specification sheets or any technical assistance you may need.

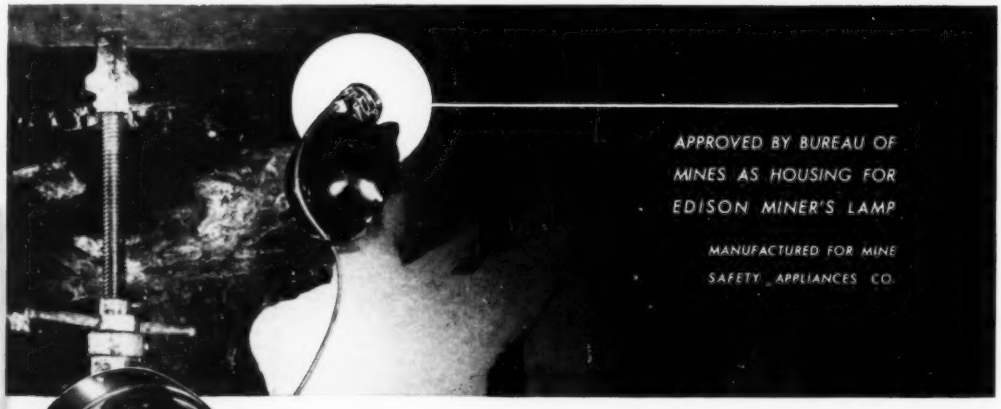
PX-104	DiButyl Phthalate
PX-108	DiIsoOctyl Phthalate
PX-109	DiNonyl Phthalate
PX-138	DiOctyl Phthalate
PX-208	DiIsoOctyl Adipate
PX-209	DiNonyl Adipate
PX-238	DiOctyl Adipate
PX-404	DiButyl Sebacate
PX-408	DiIsoOctyl Sebacate
PX-438	DiOctyl Sebacate
PX-658	TetraHydroFurfuryl Oleate
PX-917	TriCresyl Phosphate

WAD 4888

PITTSBURGH
COKE & CHEMICAL CO.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

ROGERS CORP. Impact Phenolic Specified for RUGGED DUTY



AN ESSENTIAL TOOL in underground operations, a miner's lamp must be rugged. It will be bumped, struck by dislodged pieces of coal and exposed to the action of corrosive mine water. The housing must stand up under these rugged conditions.

Rogers impact phenolic molding compound RX 428 is specified for this rugged assignment. It's tough, dimensionally stable and resistant to acids. In addition, it provides the efficient molding characteristics required of a plastics part that must be molded to tolerances of plus and minus .005".

For plastics parts with rugged assignments, investigate the wide range of Rogers preformable impact phenolics.

Please Write For Data Sheets on Rogers Impact Phenolic Molding Materials
Dept. P, Rogers Corporation, Manchester, Conn.

Better Parts for Better Products

ROGERS
CORPORATION
Established in 1832

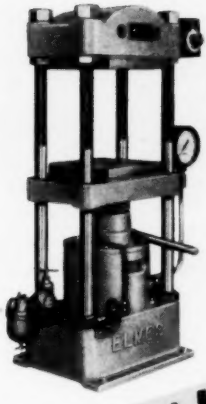
DUROIDS for Gaskets, Filters, Electronics . . .	ELECTRICAL INSULATION for Motors, Transformers, Generators . .	PLASTICS Molding Compounds and Laminates	SHOE MATERIALS for Counters, Midsoles, Liners . . .	FABRICATING Producing parts from Rogers materials

Big Results

FROM small LOW-COST ELMES PRESSES

ELMES HYDROLAIRS®

50-TON FLOOR MODEL
This model can be equipped for semi-automatic pushbutton operation as illustrated.



ELMES SMALL PRODUCTION AND LABORATORY PRESSES

30-TON BENCH MODEL
—with air rapid advance.

Quickly Pay for Themselves in Time and Money Saved!

ELMES HYDROLAIRS® bring to plastics molders an *exclusive* Elmes hydraulic principle that *cuts production costs to rock-bottom!* Hydrolairs are small, lightweight, inexpensive presses—fast, full power-operated, with continuous high-pressure stroke—*yet without the usual motors and pumps.* Hydrolairs take their power entirely from the shop air line. The pressure you select is automatically applied and maintained, even on compressible materials. Hydrolairs are compact, quiet, easily installed and moved. Supplied as complete, self-contained "packages" with nothing else to buy. Bench models to 30 tons, floor models to 50 tons.

SMALL-PRODUCTION and LABORATORY PRESSES. Powerful small units built to Elmes big press standards, these presses are *valuable aids* to plastics molders. Two types: Laboratory Press (full manual) and Small-Production Press (with power quick-closing). Fast and convenient for checking new dies . . . pre-establishing best combination of heat, pressure, and curing time before starting quantity runs . . . for research . . . and for *actual production.* Built in 20 and 30 ton bench models and floor models to 50 tons. Furnished with or without hot plates and other accessories.

Bulletin 5200-A gives complete details on Elmes Hydraulic Equipment for the Plastics Industry. Contact your Elmes Distributor or write direct for your copy.

ELMES 100th Anniversary 1851-1951 HYDRAULIC EQUIPMENT

American Steel Foundries

ELMES ENGINEERING DIVISION

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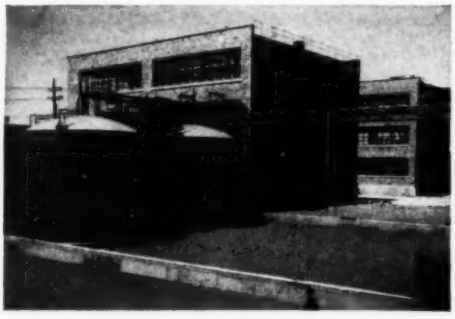
METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES



NEW MONSANTO DOP PLANT, at Everett, Massachusetts, is shipping plasticizers today.

Expanding the world's most diversified line of plasticizers

To meet the growing demand for Monsanto Plasticizers and to give even better service to the Plastics Industry, Monsanto has built a new DOP plant at Everett, Massachusetts. Your orders for dioctyl phthalate (DOP) and di-iso octyl phthalate can now be shipped from the Everett plant.

Monsanto is a basic manufacturer of DOP and of phthalic anhydride from which the plasticizer is made. From Monsanto's family of plasticizers, the world's most diversified, you can make selections to give your finished products the qualities you want to meet either price or quality competition.

Monsanto Plasticizers are readily available. Prompt shipments of dioctyl phthalate and di-iso octyl phthalate, via tank truck, can be made from Everett, New York, Akron or St. Louis. In addition, compartment tank trucks are available that make possible the purchase of these and other Monsanto Plasticizers in a single shipment at the lowest possible cost.

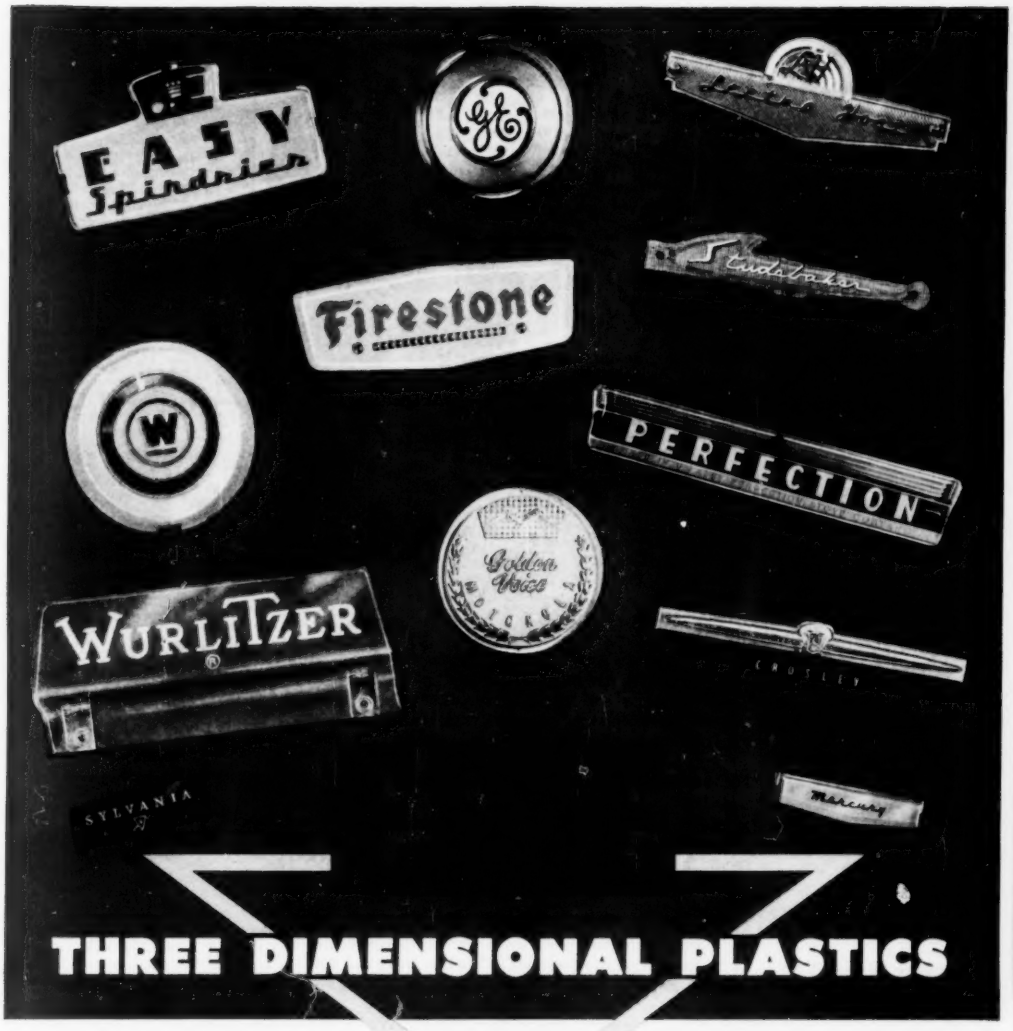
In addition to prompt delivery of a wide variety of plasticizers, Monsanto offers technical assistance in selecting the *right* plasticizers to give your products the special qualities you want. The diversified Monsanto line makes possible a "one-stop" source of supply. For information on Monsanto Plasticizers and on Monsanto's technical service, contact the nearest Monsanto Sales Office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

PLASTICIZERS

MONSANTO
CHEMICALS – PLASTICS

Serving Industry . . . Which Serves Mankind



THREE DIMENSIONAL PLASTICS

for Name Plates and Trademarks

YOUR trademark or trade name may be only a means of identification on your product. If it is custom molded of Erie Three Dimensional Custom Molded Plastics, it becomes a spot of beauty that brings your symbol to the attention of the buyer with the sparkle of a rich jewel, and enhances the sales appeal and sales value of your product. Often your trademark can be embodied in a functional part, as a handle or knob. For execution of your ideas, or for help in formulating them, come to Erie . . . the pioneer in custom injection molded plastics.

Write for your copy of bulletin,
"Who We Are . . . What We Do in Plastics."

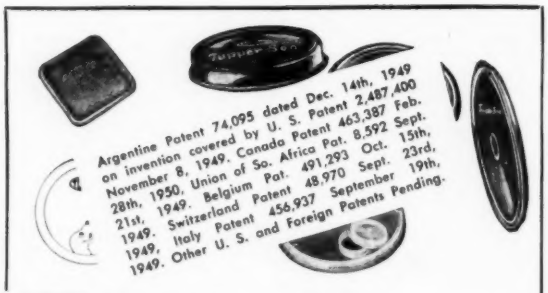
Plastics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND • • • • TORONTO, CANADA

Cliffside, N. J. • Philadelphia, Pa. • Buffalo, N. Y. • Chicago, Ill.
Detroit, Mich. • Cincinnati, Ohio • Los Angeles, Calif.

Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.



Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Other U. S. and Foreign Patents Pending.

TUPPER! Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER!

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Por Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.

The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

TUPPER

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

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These 2-color data sheets give full details of design and construction, including dimension and sectional drawings, performance data and pump specifications.

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. . . include hydraulic systems for press operations, plastic and rubber molding and extrusion. Aldrich can design and furnish your complete hydraulic system —pumps, by-pass valves, accumulators, controls.

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Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa • Export Dept.: 751 Drexel Building, Phila. 6, Pa.

Another new development using

B. F. Goodrich Chemical Company *raw materials*

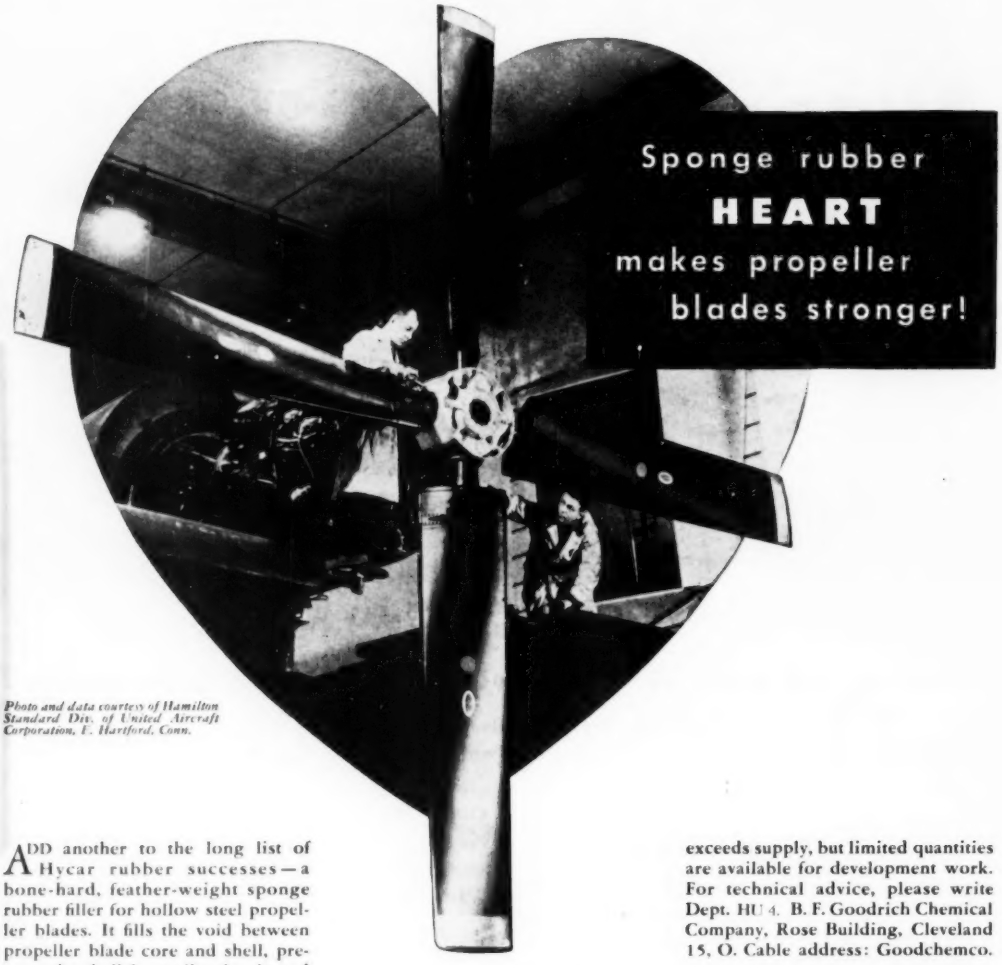


Photo and data courtesy of Hamilton Standard Div. of United Aircraft Corporation, E. Hartford, Conn.

ADD another to the long list of Hycar rubber successes—a bone-hard, feather-weight sponge rubber filler for hollow steel propeller blades. It fills the void between propeller blade core and shell, prevents the shell from vibrating in and out. It also supports the shell against the impact of rocks, ice and other material thrown up by the plane's undercarriage.

To find this filler took several years of search and tests of nearly a thousand rubber compounds. The winner contained phenolic resin, nylon, and an oil-resistant Hycar rubber compound. The presence of Hycar gives added toughness to the phenolic-nylon blend.

Hycar nitrile rubber's versatility helped make this new material possible. For Hycar has high resistance to heat, cold, cooling liquids, gas, weather and wear. It has excellent compression set characteristics, good aging properties and low moisture vapor permeability.

Hycar's advantages make it ideal for many civilian and defense products—in developing entirely new ones. Right now demand for Hycar exceeds supply, but limited quantities are available for development work. For technical advice, please write Dept. HU-4. B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, O. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Need extreme temperature resistance? Hycar has it—plus abrasion resistance and more advantages.

Hycar
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers
HARMON organic colors

HOW THOMAS TOY
set sail for bigger profits!

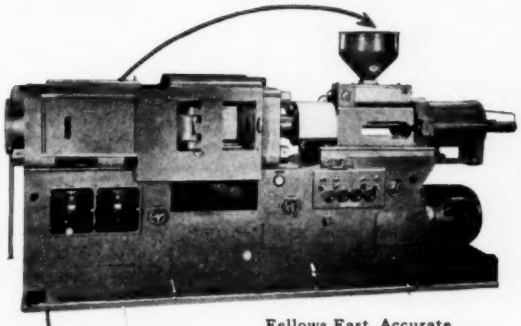
PRODUCTION DATA

DECK	
Weight	4⅓ oz.
Projected Area	78 sq. in.
Production Rate	134 per hour
HULL	
Weight	5 oz.
Projected Area	78 sq. in.
Production Rate	90 per hour

SINK-FREE
SHRINK-FREE SEAM

The Thomas Manufacturing Corp., a leading plastic toy manufacturer, of Newark, New Jersey, molds hull, deck and trim of this sink-free sailboat at money-making speed—with a Fellows 5C-8 molding machine. The shots come fast and are so accurate, so free of bubbles, rough edges and shrinkage that Thomas Toy is able to reduce costs and assembly time to a point that permits attractive retail pricing. What's more, because the 5C-8 is designed to eliminate burning and discoloration, the plastic beauty of this high-quality item invites sales and assures larger profits.

Let Fellows Injection Molding Equipment launch you toward bigger profits too! Write, wire or phone for further information today!

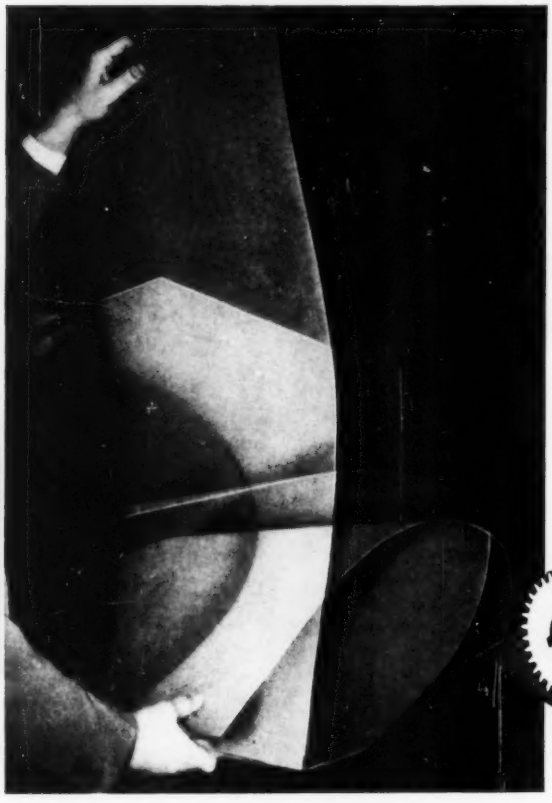


Fellows Fast, Accurate, 5C-8 Injection Molding Machine with the Famous "Speed-Flo" Cylinder.

Fellows
injection molding equipment

THE FELLOWS GEAR SHAPER CO., Plastics Machine Div., Head Office & Export Dept., Springfield, Vt. Branch Offices: 323 Fisher Bldg., Detroit 2 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1 • New England Distributor: Leominster Tool Co., Leominster, Mass.

NEW - a G-E rubber-phenolic varnish to help you make extra-tough, highly flexible laminates

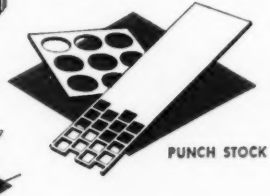


Now you can make laminated plastics with about twice the impact strength of those made with conventional varnishes! General Electric's new rubber-phenolic varnish, G-E 12359, is formulated to produce laminates for tough mechanical applications where extra-high impact resistance and greater flexibility are required.

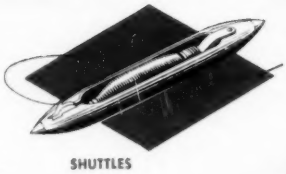
Molders familiar with G-E rubber-phenolic molding compounds, which have more than five times the impact resistance of ordinary phenolics, will appreciate the possibilities of this new rubber-phenolic laminating varnish.

SUGGESTED APPLICATIONS FOR LAMINATES MADE WITH G-E RUBBER-PHENOLIC VARNISH

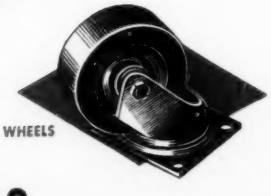
GEARS



PUNCH STOCK



SHUTTLES



CASTER WHEELS

Flexes without breaking. Laminates made with G-E rubber-phenolic varnish are extremely flexible and have twice the impact strength of those made with conventional varnishes.

For more information on G-E 12359, just write to General Electric Company, Section 123-6A, Chemical Division, Pittsfield, Mass.

You can put your confidence in—

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123-6

injection molding

All our headline has to say is "injection molding." That tells our entire story. All Ideal Plastics does is injection molding . . . every phase of it, all done in the modern, completely equipped plant you see below.

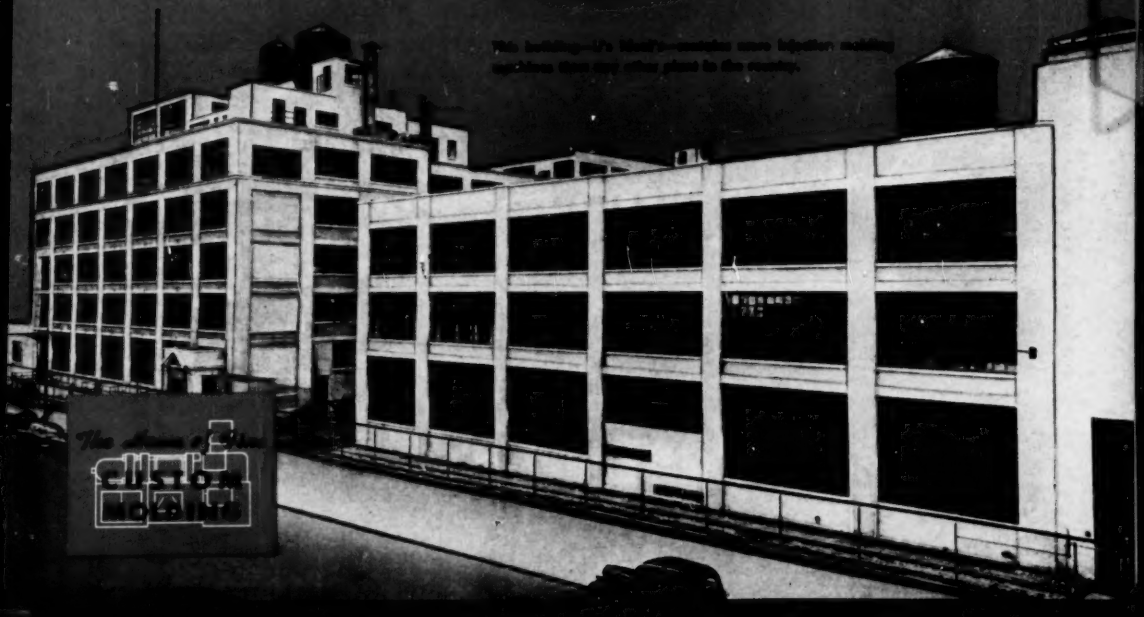
Our engineers design the molds. Artist moldmakers build them in our giant multi-million dollar toolrooms. Then the molding department takes over, skillfully transforming your plans into products. After the gates are clipped and the scars ground down, the pieces are inspected and packed for shipment.

Although this may sound like a cold, impersonal operation, that is actually far from the truth. One of the keystones on which Ideal has built its Custom Molding Department is cooperative customer service. While we would never jeopardize unauthorized design changes, we are often in a position to offer for your approval suggestions which can make the molding of your products less complicated . . . therefore less costly and faster.

You can easily see the best time to consult with us is during the design stage of your product. Our engineers will gladly work with yours. For help with your custom injection molding problems, get in touch with A. C. Maxwell, Vice President in Charge of Sales, Ideal Plastics Corporation, 154-16 Jamaica Avenue, Hollis 7, New York. Phone AXtel 7-7000. Mid-west Representative, Steel Mill Products Co., 176 West Adams Street, Chicago 3, Illinois. Phone: Central 6-8126.

Better Molded Plastics **Ideal** *for Industry & Home*

This building—it's Ideal's expansion since injection molding machines there and other plant in the country.



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A. ***Through the Phillips Cross-Recessed-Head Screws that they manufacture.*** These famous fasteners are a mark of quality manufacture to your customers. Phillips Screws are nationally advertised in The SATURDAY EVENING POST as the clue to quality: X marks the spot. You'll find them a real sales-plus on your product. What's more, you save time, work, money with Phillips Wood, Machine, Tapping Screws or "Sems." They cut driving time up to 50%, set up tighter, add structural strength. With Phillips Screws you'll find production power driving practical, cut lost time due to accidents. Be sure to cash in on their many benefits.

X marks the spot... the mark of extra quality

PHILLIPS *Cross-Recessed-Head* SCREWS

As Advertised in The Saturday Evening POST

THE FASTENERS OF TODAY . . . AND OF THE FUTURE

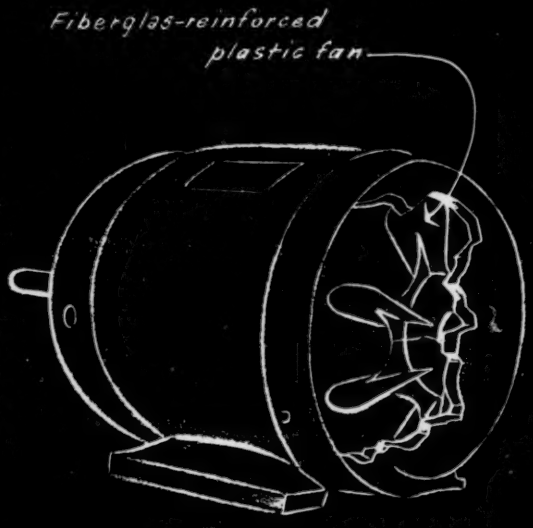
TODAY'S

Here's how a top-flight electrical manufacturer solved a costly production bottleneck with *Fiberglas**-*reinforced plastics:*

Metal cooling fans for heavy duty motors cost too much, took too long to fabricate. Besides, they often warped under high operating heat, or corroded from the effects of moisture, oils, or acid fumes.

Today, in one compression molding operation, this manufacturer produces lighter, tougher motor fans from a brand new material—*plastics reinforced with Fiberglas chopped strands!*

Result: no expensive machining—quicker, easier production—a more practical product at lower cost.



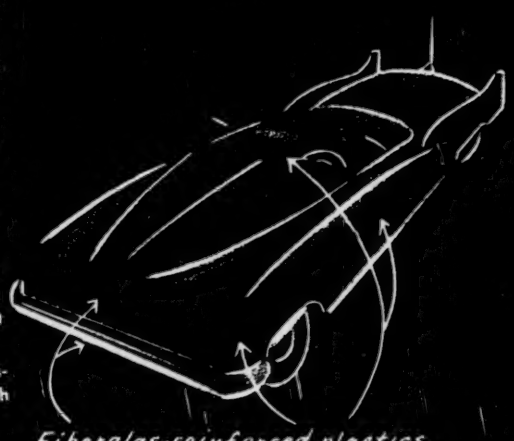
TOMORROW!

Grilles, trim, exposed hardware on tomorrow's cars must be handsomely modern, yet tough enough to take the hard knocks of normal road hazards. That's why we believe you'll see future automotive trim fashioned from molded plastics reinforced with Fiberglas materials.

Chromed to a gleaming finish, Fiberglas-reinforced plastics are lighter, stronger than metal . . . won't rot, rust, or corrode . . . and will help cars of the future look brighter, newer, far longer.

This is just one of the hundreds of ways you can utilize the versatility of today's newest construction material. Find out more about Fiberglas reinforcements now! Write: Owens-Corning Fiberglas Corporation, Plastics Reinforcement Division, 16 East 56th Street, New York 22, N. Y.

*T. M. Reg. U. S. Pat. Off.



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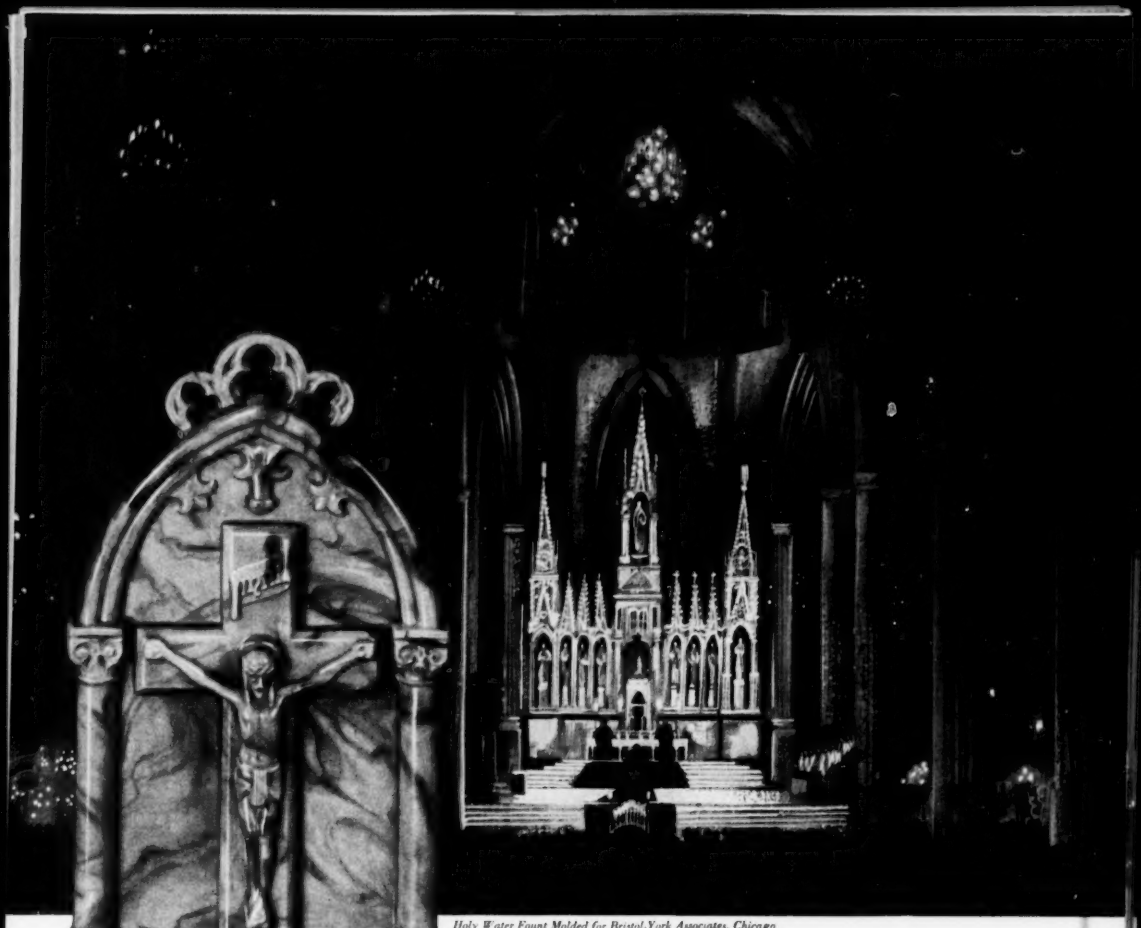
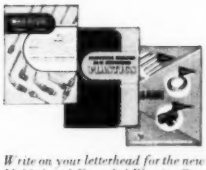


Holy Water Fount Molded for Bristol-York Associates, Chicago

Reverence...in Plastics

In molding this holy water fount, we humbly endeavored to express in it a feeling of simple beauty—dignity—reverence. This embodiment of moods in plastic materials is further evidence of our molding skill . . . an ability we feel sure can satisfy your most exacting demands in injection molding artistry and extrusion craftsmanship.

We apply equally painstaking care and skill to all types of molding assignments from the simple to the highly complex and in the desired mood, whatever it might be. Let us mold your product in the right mood for its most profitable use. We invite your inquiries without obligation.



Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about [redacted]*, piping, tubing and fittings, write for circulars containing data and illustrations.*

*Trade Mark Reg.

ELMER E. MILLS CORPORATION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Fibestos, Lucite, Nylon, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Corex, Forticel, [redacted]*, Saran, and other Thermoplastic Materials.

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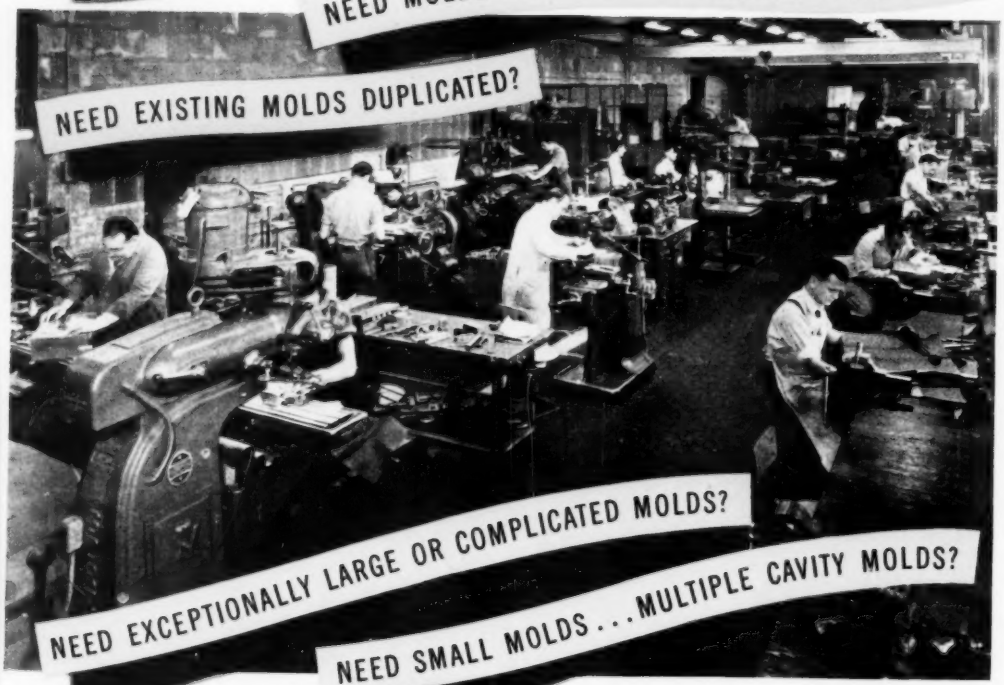
NEED ADDITIONAL MOLD-MAKING FACILITIES?

NEED MOLDS THAT POSE ENGINEERING PROBLEMS?



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One of the industry's best equipped and most ably staffed tool rooms is yours to use, here at **MPc**. Here you will find advanced types of equipment operated by highly skilled craftsmen. These men and machines have solved many a challenging problem in mold design and fabrication . . . problems encountered while **MPc** paced the advance to ever-larger plastic castings. Here at **MPc**, unmatched facilities and an unparalleled fund of experience are available for designing and tooling *your* plastic molds. Write to Molded Products Corporation, 4535 W. Harrison St., Chicago 24, Illinois.

MOLD MAKING DIVISION

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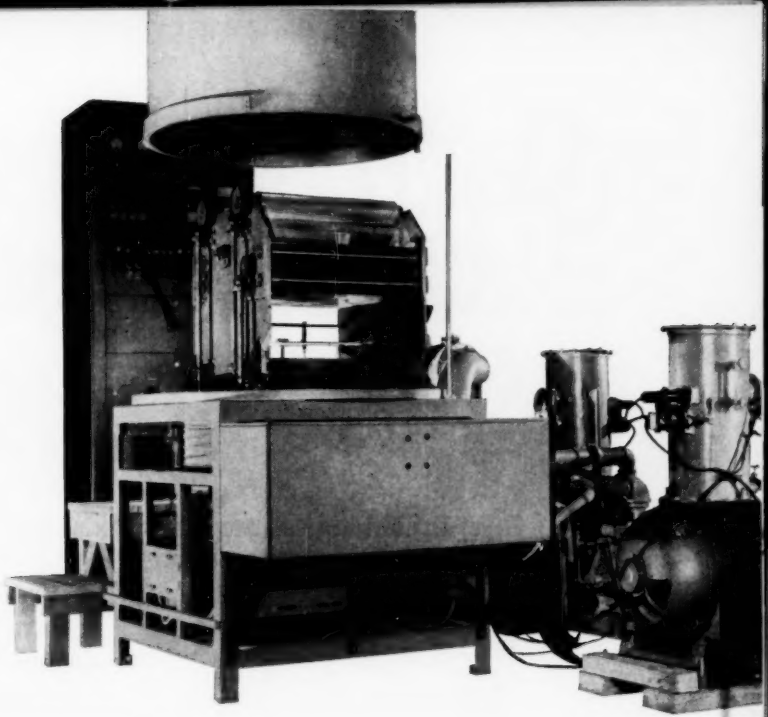
. . . Pace-Makers in Plastics Molding

FREE "Data Book of **MPc** Facilities," an engineering-eye view of **MPc** press capacities and other production facilities . . . together with a survey of **MPc** special skills available for your use. *Write for your copy.*



It turns cellulose acetate into the shiniest sheet metal you ever saw

The product is more spectacular than pictures on this page could ever show. Yet the process is not complicated and profit prospects appear to be substantial.

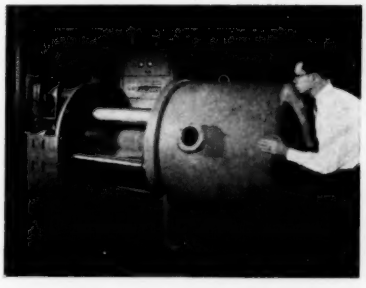
We make the equipment and it works like this:

You degas the surface of a roll of high quality plastic sheeting (Kodapak Sheet, for example) by automatically rolling it back and forth many times at high speed under moderate vacuum.

Then you transfer the roll to a machine like the one shown above. The big steel jar comes down and within a few minutes your sheet is under high vacuum. Inside, a set of crucibles, each containing a few ounces of aluminum, flash to white heat. Under the high vacuum, the heat vaporizes the metal to a gas which hits the area of sheeting passing above the crucible and condenses on it as a film a few millionths of an inch thick.

As soon as the roll has run through, you release the vacuum, raise the jar, and load in the next roll. The metallized sheet then goes to a conventional rubber roll coater for a protective coat of clear lacquer. With yellow lacquer, the metal looks like gold. Or, you can impart almost any other color desired.

For costs and more details, write ***Distillation Products Industries,*** Vacuum Equipment Department, 779 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company).



The roll of cellulose acetate sheeting is conditioned under moderate vacuum in this machine. Sheet thicknesses as high as .0075″ and as low as .0015″ work out very well. In the thinner gauges the roll can be of several thousand feet. Maximum roll width to date has been 26 inches.

DPi

high vacuum research and engineering

Also... vitamins A and E... distilled monoglycerides... more than 3500 Eastman Organic Chemicals for science and industry

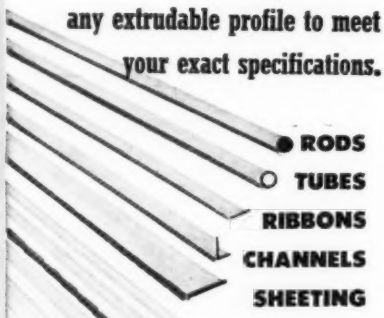
Challenge Clopay Plastics to do your job!

Clopay research has made revolutionary progress in the development of precision plastics with material characteristics of the widest versatility.

Clopay facilities and new compounding techniques offer new opportunities in the engineering of

POLYVINYL CHLORIDE
ACETATE
POLYSTYRENE
ACETATE-BUTYRATE
ACRYLICS
HIGH-IMPACT
HIGH STYRENE COPOLYMERS

Thermoplastics in any extrudable profile to meet your exact specifications.



Round, flat or unusual shapes in a complete range of colors . . . low and high temperature properties . . . hard or soft with required degree of toughness and dielectric strength to meet the most exacting specifications . . . any combination to satisfy difficult requirements for gaskets, mouldings, tubing, electrical insulation and other uses. Clopay Vinyl extrusions are an authentic improvement over rubbers (natural or synthetic) not a substitute.

For specific information write, wire, or phone . . .

INDUSTRIAL PRODUCTS DIVISION

CLOPAY corporation

Clopay Square, Cincinnati 14, Ohio
Phone: DUnbar 4800

New York: 386 Fourth Avenue, Room 608
Murray Hill 3-8066

CHECK THESE CLOPAY SERVICES

1. Fabrication of Vinyl film, supported and unsupported, and Polyethylene film for specialized uses.
2. Vinyl coating and embossing of papers and textiles.
3. Multi-color printing (surface and rotogravure) for decorative uses and military wrapping and packaging.
4. Precision fabrication of extruded and molded parts.
5. Precision slitting, electric-eye controlled cutting, die-cutting, electronic and thermal sealing, and high speed production line sewing of plastics.
6. Manufacture of cast Vinyl film for applications where uniform high strength and dielectric properties are required.
7. Complete Laboratory and Engineering facilities for research and development.

More yards per pound with calender rolls on TIMKEN® bearings

TIMKEN® roller bearings hold calender rolls in accurate alignment longer than is possible with sleeve type bearings. Roll precision is maintained, gage can be held to minimum tolerances. As a result, your yield is increased —you get more yards of plastic film or rubber sheeting per pound of material. And because rolls *stay* in alignment, you get *uniform* gage the length of the sheet.

Because there is no friction between roll neck and bearing, roll neck wear is eliminated. You have fewer overhauls. And downtime is minimized since roll necks don't require machining.

The true rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction. Wear within the bearing is negligible, calender roll precision is maintained for longer periods of time.

The tapered construction of Timken bearings enables them to take radial and thrust loads in any combination. And line contact between the rollers and races of Timken bearings provides extra load-carrying capacity.

Be sure you get *all* the advantages of Timken bearings in your calenders, mills, refiners and mixers. For full information, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

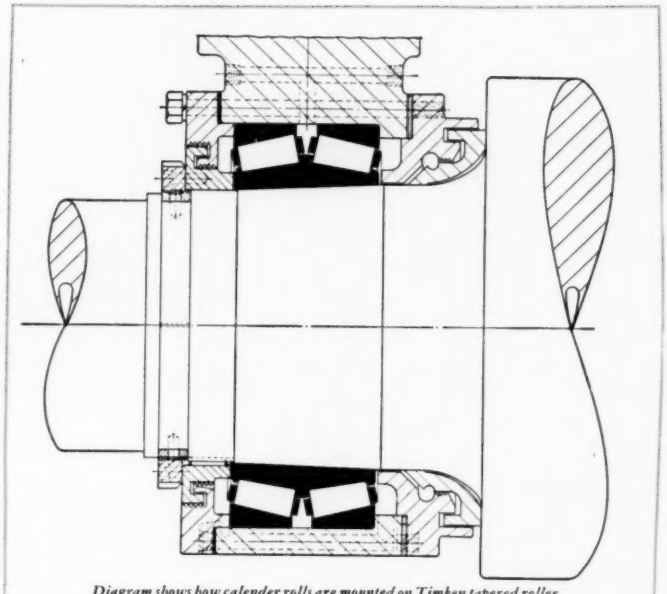
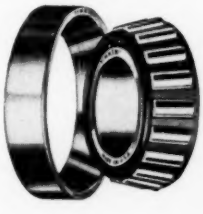


Diagram shows how calender rolls are mounted on Timken tapered roller bearings to maintain uniform gage of plastic film and rubber sheeting.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



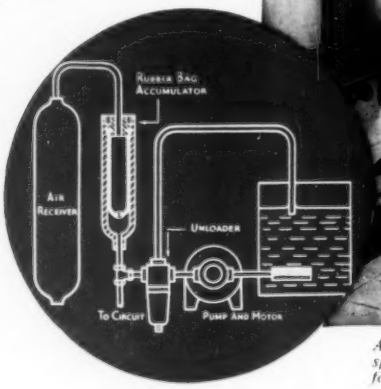
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳

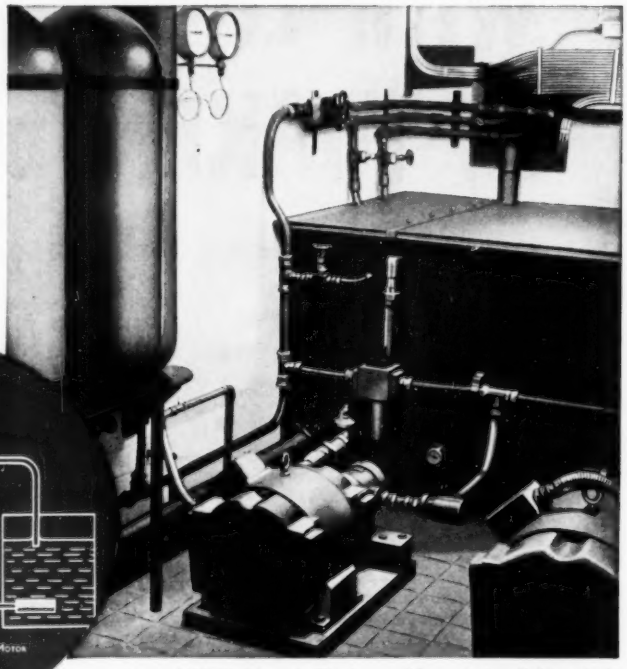
Dollar-Saving Drive

FOR WORLD'S BEST AUTO-CONTROL PRESSES

The BIPEL system of hydraulic drive is unique. It is based primarily on two novel BIPEL devices — a dual ratio (2:1 and 3:1) hydraulic intensifier on the press; and an automatic unloading valve which enables a simple fixed delivery vane pump to be combined with a gas-loaded accumulator. Pressure is generated at the highly economic figure of 1,000 p.s.i.

This medium-pressure-plus-intensifier system provides for the first time three pressures from a single source.



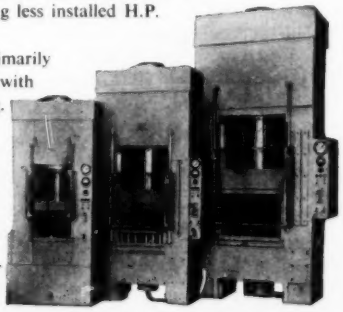


A typical BIPEL drive unit. This is one of four units installed in a single, space-saving underground chamber. A combination of any three of the four units can drive the forty presses installed.

The BIPEL drive system offers a combination of advantages that no other system can offer. It provides a compact, reliable source of hydraulic motive power, cheaper than any other to buy and operate. And, for the first time, it enables a down-stroking prefiller press to provide, from a single supply source, a choice of three molding pressures at will — the initial line pressure followed by intensified pressures of two or three times that figure.

The maximum advantage is derived when the equipment is installed as a group drive feeding a number of presses, up to ten or twelve. Or, as a built-in unit operating a single press, it has many advantages over conventional high-pressure pumps; it still remains simpler and cheaper, requiring less installed H.P. to drive and retaining the feature of three operative pressures.

The BIPEL system, whilst also applicable to manually operated presses, is primarily designed for auto-control which enables the press to reproduce automatically with unvarying precision, any conceivable molding cycle including dwelling and breathing.



BIPEL presses are made in three models, each affording three molding pressures.

TYPE 40: 20, 40, 60 TONS
TYPE 100: 50, 100, 150 TONS
TYPE 200: 100, 200, 300 TONS

B.I.P. GROUP

B.I.P. ENGINEERING LTD., ALDRIDGE ROAD, STREETLY, STAFFS., ENGLAND

modified polystyrene—Koppers MC 401—bridges the gap!

HIGH IMPACT PLASTIC

KOPPERS MC 401

REGULAR POLYSTYRENE

Molders have long wanted a thermoplastic which combines the toughness and shock resistance of "high impact" polystyrenes with the desirable characteristics of regular polystyrene. Koppers Modified Polystyrene MC 401 was developed to satisfy this need, and initial applications of this new Modified Polystyrene are being received enthusiastically.

Good shock resistance, toughness and finish suggest Koppers MC 401 for toys, refrigerator parts, household appliances and housewares as well as for battery cases and a wide variety of packaging applications. It is available in standard and special opaque colors.

Koppers MC 401 may be either injection-molded or extruded, and its molding characteristics, like its physical properties, combine the qualities of both regular and shock resistant polystyrenes.

Write for free Bulletin. C-2-161-T which details molding characteristics, physical and chemical properties and other information about Koppers Modified Polystyrene MC 401. This bulletin also contains information about Koppers Modified Polystyrenes MC 185 and MC 301. Koppers technical staff is anxious to help you develop new product applications for all Koppers Plastics. Phone, write or wire, and a Koppers representative will gladly call to discuss your problem.

Koppers Plastics make Many Products Better and Many Better Products Possible.

KOPPERS

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The fault was in choosing the wrong type fastener . . . but

THE MOLDER WAS BLAMED

When "tough breaks" like this occur —and they happen too often in assembly with plastics parts—it's the custom molder, usually, who gets the blame. Yet, all too often, the fault lies *not* with the molding compound but with the fasteners used by the manufacturer.

Use of the wrong *type* of fastener may not only damage the molder's reputation unfairly . . . it can *wipe out* your profits, through parts spoilage and increased production costs. That's why so many good custom molders, interested in their customers' problems, get recommendations first from Parker-Kalon.

First, because Parker-Kalon makes a complete line of Self-tapping Screws —will fit the fastener to your special needs, *not* your needs to the fastener.

Second, because Parker-Kalon, originators of Self-tapping Screws, learned long ago how to keep hardness and toughness properly balanced in *every* screw—learned to maintain the uniform quality that keeps fast-moving assembly lines trouble-free. And there's no substitute for 35 years experience.

So question the efficiency of your fastening method before you blame your molder. Call in a P-K Assembly Engineer—preferably at the design stage. It will pay you—in fewer rejects, faster assembly, and help your molder serve you better. Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y. Sold everywhere through accredited Distributors.

*TRADE MARKS REG. U.S. PAT. OFF.

P-K TRADE MARK

The Original

PARKER-KALON* SELF-TAPPING SCREWS

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

...ared TO SERVE THE ENTIRE PLASTICS INDUSTRY

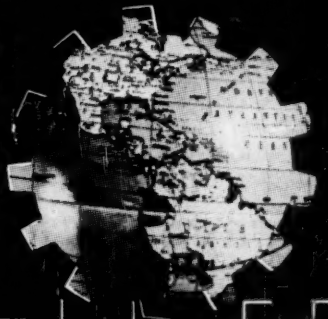
a complete **PLANT**

for a complete **SERVICE**

WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.

- **WE BUY THERMOPLASTIC SCRAP** — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
- **WE CUSTOM COMPOUND** your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
- **WE EXTRUDE** any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.

DRYCOL —offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.



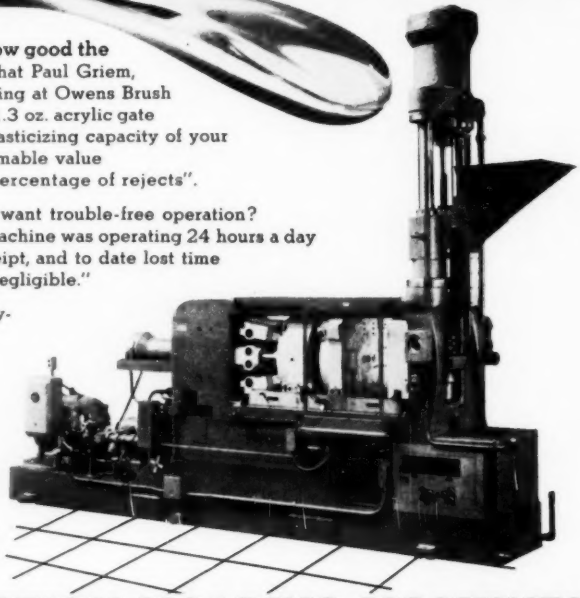
GERING *Products*

11.3 OUNCES OF ACRYLIC
from a 12 Ounce LESTER
at OWENS BRUSH

Only our customers *really* know how good the new Lester machines are. Here's what Paul Griem, vice-president in charge of manufacturing at Owens Brush in Toledo has to say (referring to the 11.3 oz. acrylic gate of brush backs shown here), "... the plasticizing capacity of your new 12 oz. Lester has proven of inestimable value in reducing both the cycle and the percentage of rejects".

But that's not the whole story. Do you want trouble-free operation? Again we quote Paul Griem: "the first machine was operating 24 hours a day under full load within 96 hours of receipt, and to date lost time for repairs on this machine has been negligible."

That's the kind of story you hear everywhere—Lester machines are living up to every claim, giving day-in, day-out, trouble-free performance. Complete specifications for the machine of your choice are available on request. Write today.



Write for free Copy of the Lester Press

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IDEAS *in the making*

Araldite Bonding, Casting and Coating Resins developed by Ciba Research are simplifying manufacturing methods, improving product efficiency, and opening new fields of product development. You will want to know more about them.*

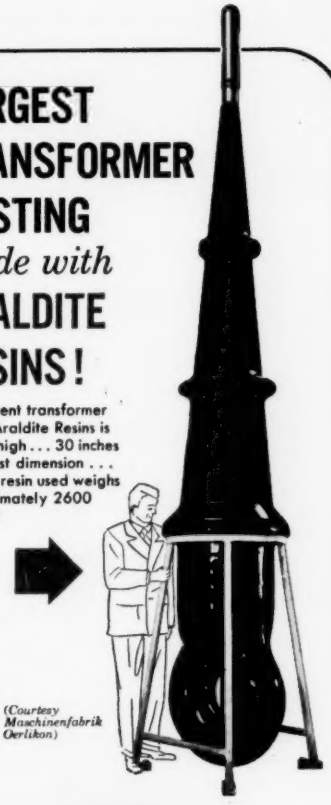
Permanent, trouble-free Slip Ring Assemblies are perfected with **ARALDITE** *Resins*

Wire leads are securely imbedded in ARALDITE RESINS. Hard silver concentric rings are plated to this precisely machined one-piece plastic form making rings integral part of complete unit in which "specs" are met with degree of accuracy never before achieved in production, for all sizes and quantities.

(Courtesy Electro-Tec Corp.)

LARGEST TRANSFORMER CASTING *made with* ARALDITE RESINS!

This current transformer cast in Araldite Resins is 12 feet high . . . 30 inches at widest dimension . . . and the resin used weighs approximately 2600 pounds!



(Courtesy Maschinenfabrik Oerlikon)

SEND THIS COUPON . . . or write us on your company letterhead . . . for complete technical data on the physical properties and recommended procedures for the successful use of Araldite Resins for your own fabricating needs.

M. P.

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There's no MAGIC in solving your PLASTICS problems . . . JUST EXPERIENCE AND KNOW-HOW

No, there's no magic in producing plastics parts to meet specific requirements. It's just a combination of experience, know-how and hard work. For several years, we, here at Quinn-Berry, have been designing and producing plastics parts for virtually every industry. In so doing, we have gained a world of experience and know-how. These important factors are yours for the asking.

The next time that you have a problem involving plastics, call Cubee. All the facilities necessary are here under one roof—one responsibility. We are sure that you will profit.

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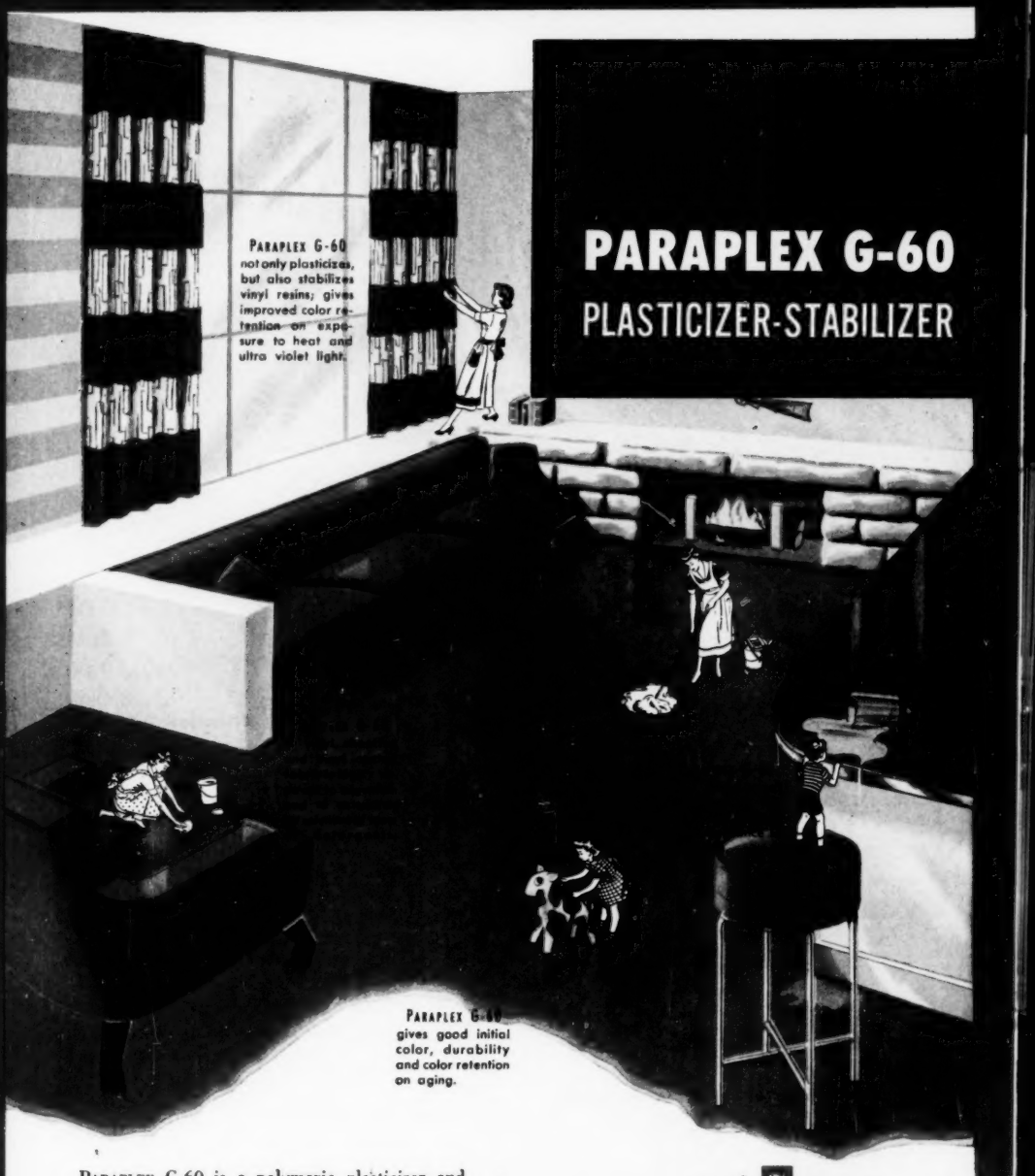

PARAPLEX G-60
PLASTICIZER-STABILIZER

PARAPLEX G-60 is a polymeric plasticizer and stabilizer for vinyl resins. It readily meets processing requirements in rigorous, high speed, high temperature schedules—has the permanence needed in virtually every vinyl application. Cost is low. For a convincing demonstration, ask for a sample of PARAPLEX G-60.

For general use or specialties, one of the PARAPLEX or MONOPLEX plasticizers should meet your needs. Write for this 43-page plasticizer manual.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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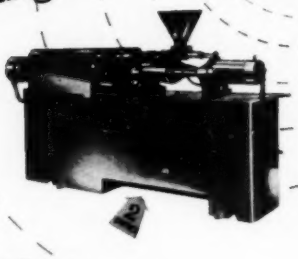
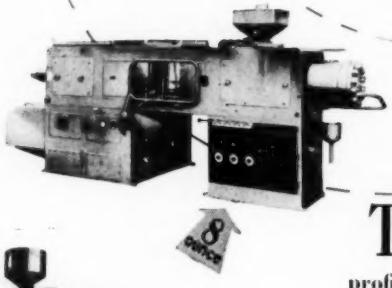
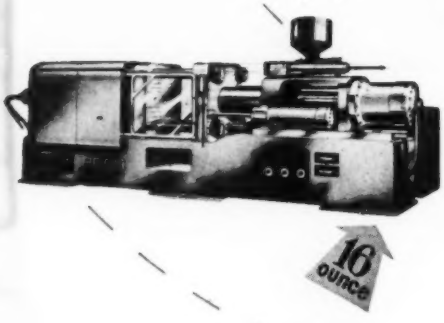
focus on injection moulding machines

PROJECTILE PRODUCTS PECO







THE attention of Plastics manufacturers may profitably be centred on PECO Injection Moulding Machines, for they are designed to give high productivity through maximum efficiency.

They are built in 2oz., 4oz., 8oz., and 16oz. capacities. They represent the most up-to-date development of this type of plant.

Full particulars will be sent on request.

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if desired. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000-ton Hobbing plant. Master Hobs to customers' samples made as required.

THE PROJECTILE & ENGINEERING COMPANY LTD.

ACRE STREET, BATTERSEA, LONDON, S.W.8, ENGLAND

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NO. ½ T. D.
MATERIAL GRANULATOR

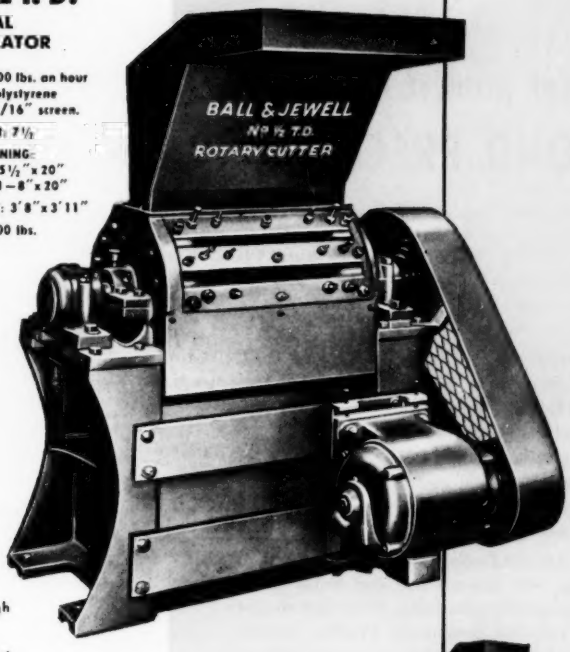
CAPACITY: 500 lbs. an hour based on Polystyrene scrap with 5/16" screen.

HORSEPOWER: 7½

THROAT OPENING:
Regular—5½" x 20"
Model 451—8" x 20"

FLOOR SPACE: 3'8" x 3'11"

WEIGHT: 1100 lbs.



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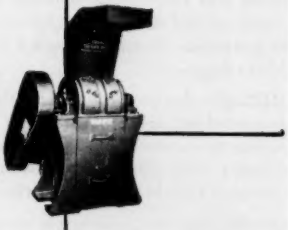
Small floor space required but high capacity

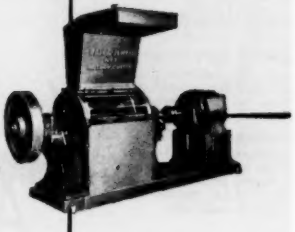
Available with large throat for material that is difficult to feed

Convenient material collecting bin

Easily accessible for cleaning



Require A Smaller Machine?
B & J STANDARD IDEAL
Throat opening: 3½" x 10" or 6" x 10"
Horsepower: 2
Capacity: 250 lbs. an hour



Require A Larger Machine?
B & J No. 1 CUTTER
Throat opening: 7" x 24"
Horsepower: 10
Capacity: 750 lbs. an hour

Your grinder source for every individual plastic material cutting requirement and capacity (50 to 3,000 lbs. per hr.)—Ball & Jewell, machine tool builders since 1865, have always paced the grinding needs of the plastics industry. Send us your requirement specifications.

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Chemicals you live by

your product has more to offer with

DIAMOND PRECIPITATED $CaCO_3$

There is a DIAMOND Precipitated Calcium Carbonate to meet almost every requirement of the rubber compounder. All are chemically precipitated under accurately controlled conditions to produce the highest degree of uniformity and purity. Your nearest DIAMOND Sales Office can help in selecting the type and grade most suited to your requirements.

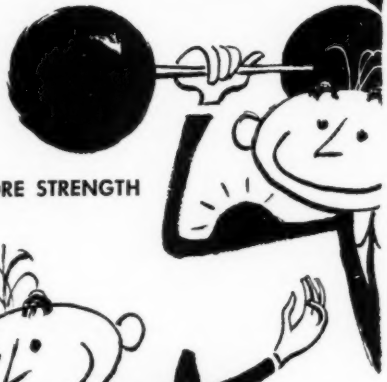
***SUPER MULTIFEX**®*—ultra-fine particle, coated $CaCO_3$. Greatly increases tear resistance of natural rubber and GR-S and also gives good tensile strength and low modulus. Gives excellent flow properties to molded compounds.

***MULTIFEX MM**®*—uncoated precipitated $CaCO_3$. Particle size slightly larger than SUPER MULTIFEX and therefore has slightly lower reinforcing effect. Requires less power to incorporate.

***KALITE**®*—a semi-reinforcing coated filler which, at proper loading, will increase tear and tensile properties. Imparts specific processing advantages to calendered and extruded compounds. Provides smooth surface, reduced shrinkage, higher tube speeds with low heat generation. Recommended for highly loaded soft rubber compounds.

***MILLICAL**®*—due to fine particle size, this uncoated precipitated calcium carbonate exerts a stiffening effect on green or uncured compounds. Prevents sagging or collapsing when cured in open steam. Recommended as primary filler in rubber floor tile.

***NON-FER-AL**®*—an economical non-reinforcing filler for use in highly loaded compounds where low modulus is desired. Very pure. Non-abrasive.



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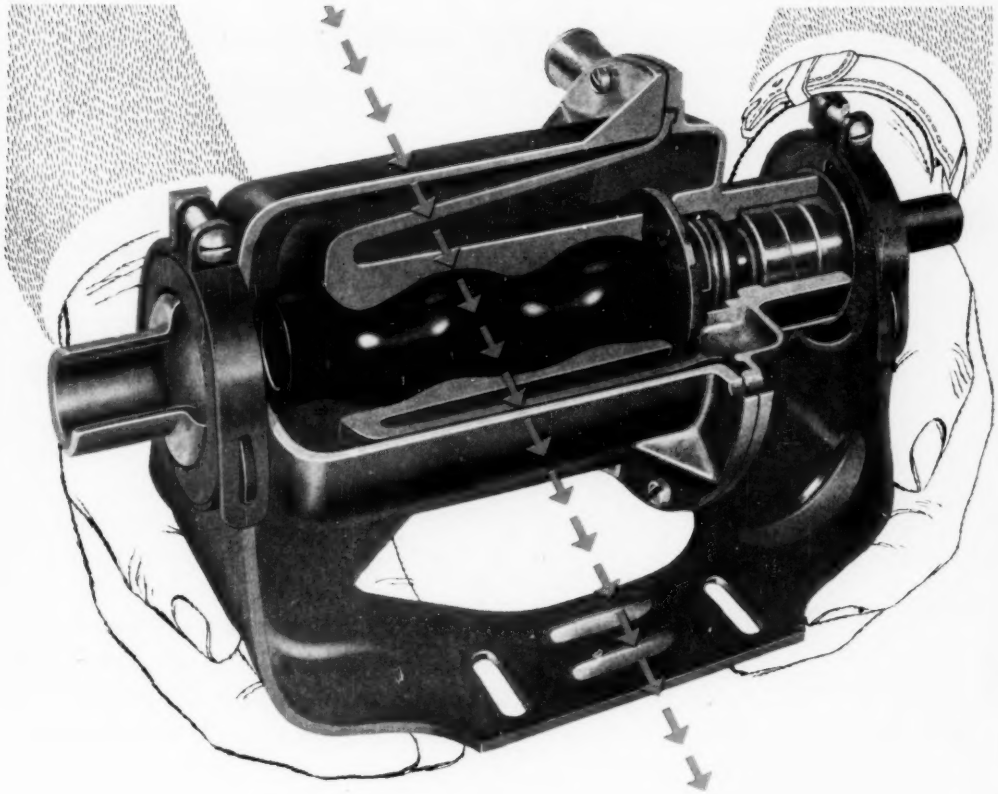

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MODERN PLASTICS

VOLUME 29 AUGUST 1952 NUMBER 12

BETTER CARS —More Plastics

Survey of the automotive industry shows the older materials well established, the newer materials rapidly gaining larger volume

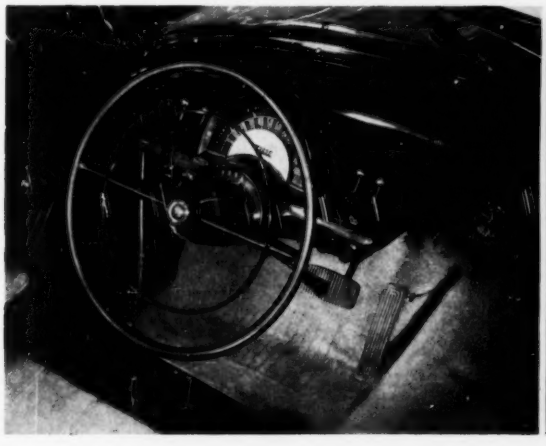
IT has been truthfully said that the automobile of today literally starts, runs, and stops with plastics. As a result, the automotive industry ranks as one of the most important industrial markets for plastics.

In 1950 there were approximately 53 million passenger cars, trucks, and busses in operation in the United States and since that year at least 15 million new passenger car units have been manufactured. Every car on the road today, and every car being produced, has a variety of plastic components which contribute importantly to safety, performance, and appearance. The record is brilliant, but there are still greater triumphs to come.

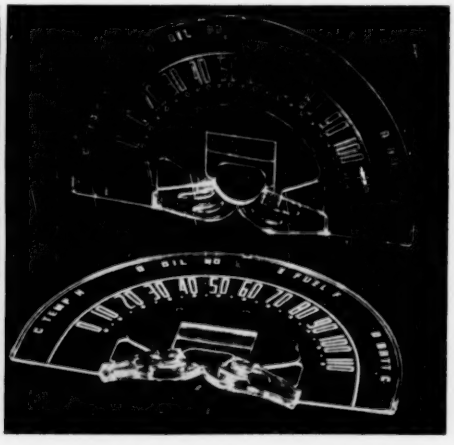
The following picture of the automotive industry, prepared as the result of a MODERN PLASTICS survey, must necessarily be painted with a broad brush. The whole story in detail would require volumes. Hence the primary purpose is to high-light major applications of plastics now being used as standard factory equipment and to suggest future developments.

Much of the experimental work now being done by automotive manufacturers cannot be discussed for competitive reasons, but the MODERN PLASTICS survey shows that a definite pattern can be established. The automobile people are taking plastics very seriously; they are taking every advantage of the properties of plastics; they are using the materials with greater imagination and sounder purpose than ever before. Decorative uses of plastics

1952 Mercury has butyrate knobs, acrylic horn ring medallion, and instrument panel cluster molded of acrylic and edge lighted from below (see right)



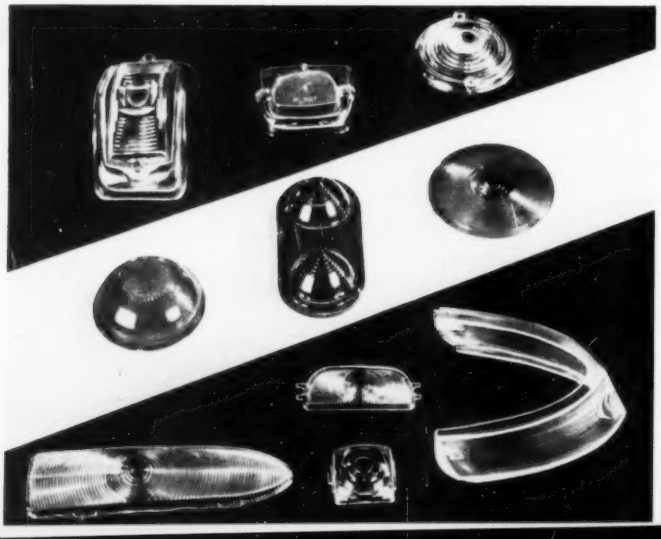
Transparent acrylic panel cluster crystal for 1952 Mercury has calibrations molded-in to back surface and filled with lacquer



Colorful horn buttons, dashboard emblems, and medallions for hood and rear of cars are molded of clear acrylic and then sprayed from the rear in a number of colors. Thus colors are protected from wear and have appearance of rich depth

Color plates courtesy Rohm & Haas Co.

Lenses for parking lights, license plate lights, tail lights, and turn signals are molded of acrylic. V-shaped piece (bottom right) is lens for a Cadillac back-up light



still loom large in the picture, but many new functional applications are coming forward and may be expected to grow in volume.

Because of the diversity of plastics usage in the modern automotive vehicle, the following discussion is organized on the basis of the major types of plastics involved.

ACRYLICS

In point of volume and variety of application, acrylics are now far and away the automotive industry's favored plastics. They make important contributions to styling, identification, safety, and utility. A number of these applications, such as tail lights, hood emblems, and steering post medallions, have now been adopted as standard by virtually 100% of the manufacturers.

Molded acrylic tail light lenses have advantages over glass of increased styling latitude, greatly reduced breakage in assembly and use, better molding tolerances, lighter weight, superior color, and optical properties. Breakage on glass lenses, for example, used to run as high as 30% in shipment, handling, and assembly. So much better is acrylic that the angle of cost—the one score on which glass lenses hold the edge—is no longer a primary factor. These same considerations apply not only to tail-light lenses, but also to lenses used for parking lights, back-up lights, direction signals, etc.

Until a few years ago, tail lights were relatively small and not generally designed as an integral part of the car body. Then came modern styling trends, pioneered by Cadillac's upswept tail fins in 1949, in which the tail light became part of the rear fender contour. The variety of lens shapes thus demanded is readily obtained with molded acrylic, but would be out of the question with glass.

More Than Meets the Eye

There is much more to a molded acrylic tail lamp lens than the flowing exposed surface which meets the eye. Many have intricate concentric ridges and other optical treatments on the inner side. A reflex reflector, comprising a geometrical arrangement of minute cubical facets, is usually molded directly into the lens shell or incorporated in

Where Plastics Contribute To Automotive Safety, Performance, Appearance

ACRYLICS

- Tail light lenses
- Parking light lenses
- Back-up lights
- Direction signals
- Reflectors
- Hood ornaments
- Hood emblems
- Horn buttons
- Steering post medallions
- Rear deck ornaments
- Instrument panels
- Headlight dimmers

NYLON

- Dome light lenses
- Door striker wedges
- Speedometer gears
- Shaft bushings
- Grommets
- Electrical components
- Oil valve components
- Pedal seals
- Radio antennas
- Pump couplings
- Door hinge bushings

ACETATE AND BUTYRATE

- Control knobs
- Radio grilles
- Moldings
- Dial pointers
- Bezels
- Brake handles
- Steering wheels
- Gear shift knobs
- Grab rails
- Baggage racks
- Arm rests

COPOLYMERS

- Station wagon roof rails
- Wheel house covers
- Seat backs
- Seat side panels
- Crash panels

REINFORCED PLASTICS

- Sports car bodies
- Car tops
- Hoods
- Trunk lids
- Seat frames
- Glove compartments
- Trunk liners
- Scuff plates
- Fender skirts

VINYLS

- Upholstery
- Scuff pads
- Electrical components
- Fender welts
- Socket seals
- Convertible windows
- Door panels
- Arm rest padding
- Waterproofing
- Valve caps
- Door bumpers
- Gaskets
- Pedal pads
- Glass seals
- Safety glass

THERMOSETS

- Electrical insulation
- Waterproofing
- Electrical connectors
- Carburetor parts
- Water pumps
- Radiator strainers
- Plated parts
- Brake linings
- Clutch disks

the assembly as a separately molded unit.

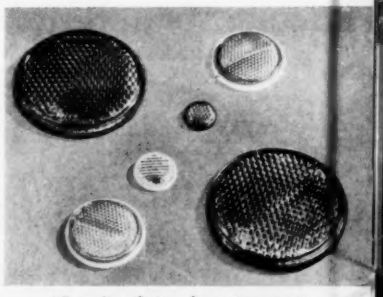
Outstanding among the newer acrylic tail lights are those on Lincoln cars. The outer shell measures 10¼ in. high and weighs approximately 1 lb.; the complete assembly is the largest and heaviest plastic tail light ever used in standard production. Each lamp is made up of three molded acrylic parts—the red outer shell, a clear internal plate containing the lamp "bee hive" and the Stimsonite reflex reflector area, and a clear acrylic divider plate—weighing 24 oz. total.

The new Ford tail lights incorporate an unusual two-color treatment. The entire lens is molded in red acrylic; then the base section receives a coat of aluminum paint (soon to be replaced by vacuum deposited aluminum) on its exterior surface, followed by a protective coat of clear lacquer. This arrangement eliminates the need for a combination metal and plastic assembly, reducing the total cost of the unit.

There is a great deal of interest among automotive lighting engineers in the idea of two or more colors in the tail light assembly. Ultimately, the desired result may be achieved by molding alone, without supplementary painting or decoration. On the horizon, but not yet on the road, is a two-color acrylic tail light lens, which would obviate such problems as paint adhesion and extra finishing operations.

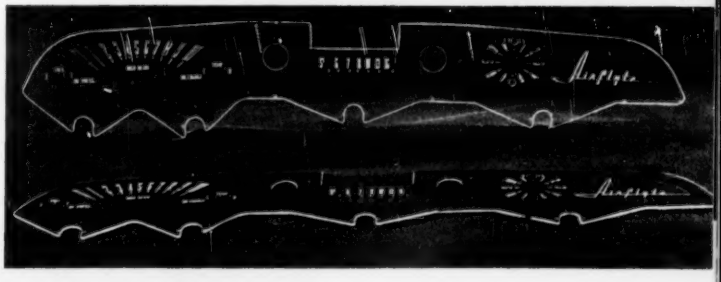
Decorative Parts

Other molded acrylic applications used by the automotive indus-



All-acrylic reflectors have transparent front pieces, opaque back sections

Instrument panel crystal for Nash is 30 in. long, combines fuel gage, speedometer, clock face, radio dial, and name plate. Letters and numbers are molded-in to back

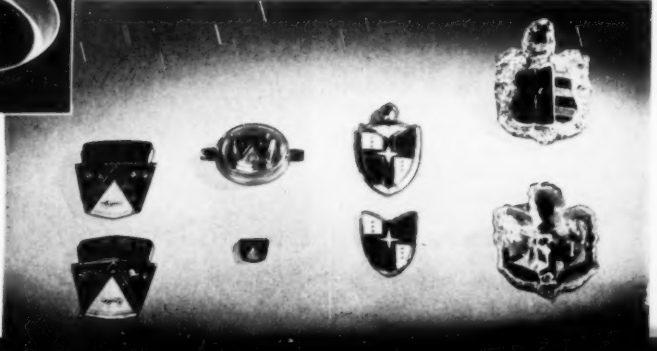


Plastics applications on rear of 1952 Mercury include molded acrylic rear deck ornament, and acrylic tail light lenses

Typical horn buttons and medallions are those for the Willys (top), Plymouth, Kaiser, Studebaker (center), and Buick

Dash panel for General Motors Coach is lacquered on rear so that letters show only when panel is lighted

Metallized acrylic head light trim ring takes the place of chrome plated metal



Almost all cars have acrylic emblems like these for Ford, Mercury, Dodge

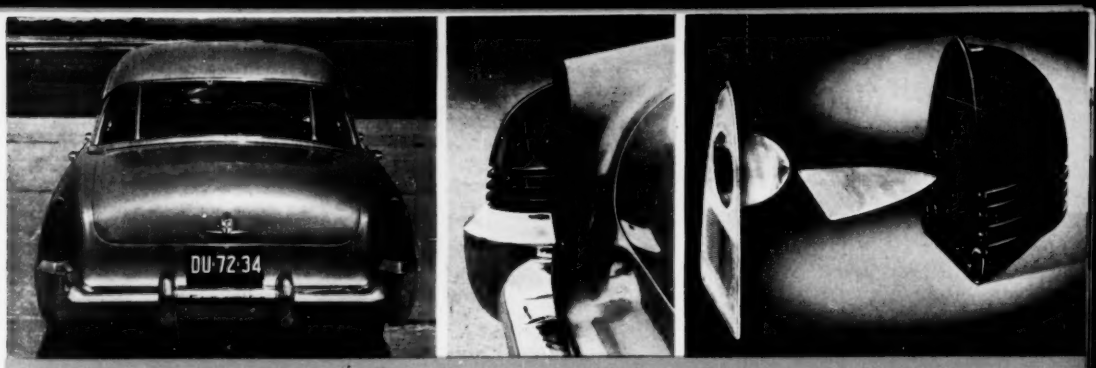
try include decorative or functional parts, ranging from hood front emblems, hood ornaments, and steering post medallions to rear deck emblems and similar components. Most of these pieces are intaglio molded with details on the inner surface. "Second surface coatings" are then applied by vacuum metallizing and other techniques to produce a finished part of jewel-like brilliance and color; applied colors and metallic coatings are protected by neutral "back up" coat.

Acrylic hood front medallions are customarily designed to fit a chrome plated die-cast frame or bezel secured to the hood. An interesting exception is the colorful Dodge emblem, which has a molded-in black enameled metal front plate which, in turn, is riveted to a rear bracket that attaches directly to the hood by means of threaded studs, providing a pilfer-proof mounting; no metal bezel is required.

Dodge and De Soto are using small molded nameplates which are affixed to the dashboard. These replace similar nameplates of chrome plated die-cast metal. In order to secure maximum strength in the letters, which are somewhat thin in section, they are molded of clear ethyl cellulose and metallized by vacuum deposition.

Bezels Eliminated

The technique of vacuum metallizing clear acrylic pieces on the back surface is now being employed by automotive manufacturers to simulate chrome plated bezels and thus effect economics in production and assembly. This work has already made its appearance on some Chrysler-produced cars in parking light lenses, instrument panel dials, and similar parts. These lenses are molded with a border to which vaporized aluminum coating is ap-



Acrylic tail lamps of 1952 Lincoln are the largest ones molded. Each consists of a 1-lb. outer shell and a clear acrylic optic plate containing a reflex reflector area and a bee hive shaped compartment for the bulb. Divider plate separates turn signal

plied on the reverse side. A back-up coating is then applied to shield the vaporized aluminum coating against damage and weathering. The appearance of the finished part faithfully duplicates that of lens and bezel assembly.

A lens of this type, comprising a combination parking and turn signal light, was introduced by Dodge in 1951. The lens proved so successful in use that similar lenses are now being used by at least one other producer in license and parking lights, as well as on such interior parts as clock opening covers and other dashboard applications.

Some automotive men are cautiously optimistic regarding the future of such simulated bezel applications. They point out that the metallized portion of a plastic lens will maintain its original appearance longer than a chrome plated metal part, and that the two should not be used in close proximity on the car, lest the plated metal show up at a disadvantage. Another statement heard is that metallized acrylic parts do not give a true match with chrome plated metal. Material suppliers say that this problem can be met by using a molding material with a slightly bluish tint which is not apparent in the finished part.

Latest application of molded acrylic lenses is a prismatic condensing unit in the Oldsmobile "Autronic Eye," a device which dims the headlights when another car approaches.

Dash Panels

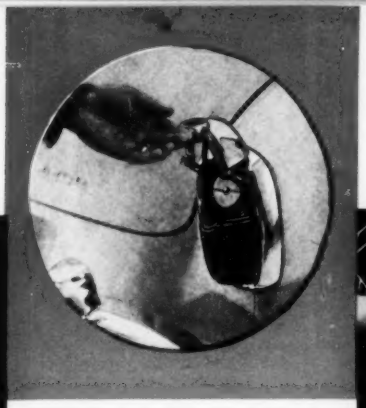
By molding a part of clear transparent acrylic and carefully controlling the opacity of the lacquer coating applied to the back of the piece, instrument or signal lamps may be mounted behind the dash panel so that printed-on lettering is concealed except when illuminated. An example of this technique is an acrylic instrument panel part used by General Motors Coach. Nearly 16 in. long and weighing just under 4 oz., the molding has debossed and intaglio lettering on the underside. Color and vacuum metallizing are applied from the back, and silk screened notations for the driver are printed in reverse. These read "hi beam," "stop lamp," "exit door," "turn sig.," etc. Individual bulbs in a shielding arrangement behind each word light up a circle of approximately ¾ in. as required. When all the lamps are off, the notations cannot be seen from the front side of the piece.

Entirely different in treatment is the large clear transparent acrylic instrument panel used by Nash. This part is 29½ in. long, a maximum of 5 in. wide, and weighs 9½ oz.; maximum thickness is 5/32 inch. All calibrations are intaglio molded

Ford tail light lens has aluminum coating on base portion. Center section has integral reflex reflector

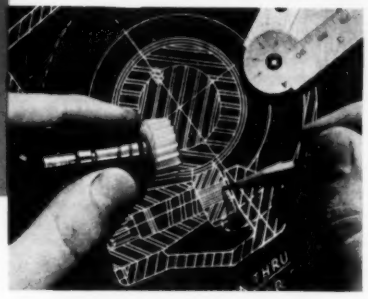
Ford parking lamp has styling details possible with molded acrylic but difficult to produce in a glass part

Hood ornament on 1952 Henry J is combination of molded acrylic and chrome plate metal components



Upper portion of right tail light on 1952 Nash is hinged for easy access to fuel tank. Lenses are molded of acrylic

Ford speedometer gear now molded of nylon costs 50% less to produce, lasts longer than did metal gear



on the reverse side and filled with gold lacquer. Edge lighting from concealed bulbs makes the instrument readings and notations easily visible at night without throwing excessive light in the eyes of the driver.

In a semi-circular type of instrument panel cluster used by Mercury, speedometer calibrations and markings for the temperature indicator, oil pressure, fuel, and battery are intaglio molded on the reverse side of the part and filled in with white lacquer. The clear transparent acrylic piece is molded with a thick, "butterfly" shaped section at the lower center and an integral rectangular magnifying lens which makes the odometer figures easier to read.

In addition to the applications cited above, molded acrylics are widely used in reflex reflectors on trucks, busses, and other vehicles.

NYLON

Only a short time ago, few automotive applications of molded nylon could be found except dome light lenses—which, incidentally, continue to find favor. A study of the 1952 cars reveals molded nylon moving into a number of new mechanical applications, ranging from door striker wedges and speedometer take-off gears to brake pedal arm bushings, brake cylinder push rod bushings, and garnish grommets, as well as various electrical components.

Ford was one of the first auto makers to specify molded nylon for functional parts. These included speedometer take-off gears tested to the equivalent of 100,000 miles at 80 m.p.h. and door striker wedges which, requiring no lubrication, eliminated grease smears on the clothing when entering or leaving the car. Chevrolet, Pontiac, and Packard have now adopted nylon speedometer gears and the application has been approved for use on the Chrysler line.

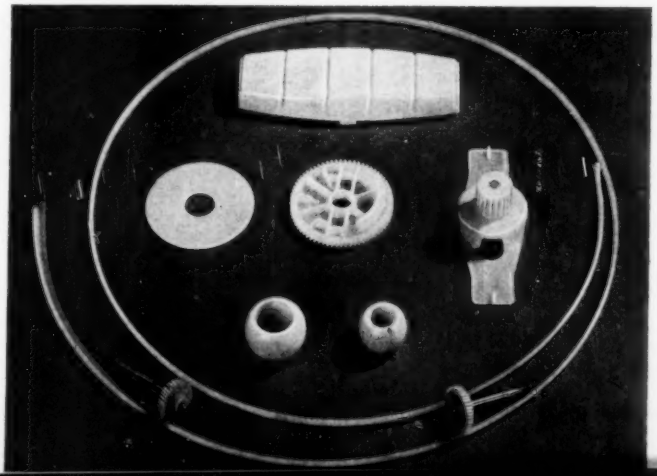
Ford's satisfactory experience with nylon paved the way to several additional applications on the 1952 models, and other potential uses are being evaluated. Among the new nylon parts being used by Ford are brake pedal arm bushings, brake master-cylinder push rod bushings, horn ring insulators, and a component of an oil valve.

Automotive engineers state that nylon can definitely compete with powdered metal and bronze non-ferrous bearings, and they predict that such applications will multiply rapidly. Nylon can replace metal or laminated synthetic materials in mechanical parts on a cost basis if two requirements are satisfied: 1) that the number of parts required be reasonably large, to distribute mold cost, and 2) that the piece be fairly complex, requiring extensive fabrication if other materials are used.

Superior Performance

In some instances, the original part will cost more in nylon, but the

Nylon molded parts for various cars include dome light lens (top), pedal seal, wiper gear, and pump coupling (center), clutch shaft bushings, and antenna rod and gears

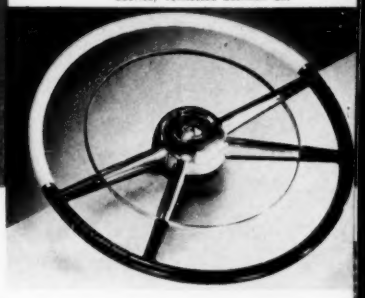


Molded nylon gear in electrically driven windshield wiper mechanism outperforms metal and costs less

Automatic electronic device which lowers headlight beam when car approaches has prismatic condensing lens made of acrylic

Two-toned steering wheel for Ford is molded of butyrate over steel core in two separate operations

Courtesy Tennessee Eastman Co.



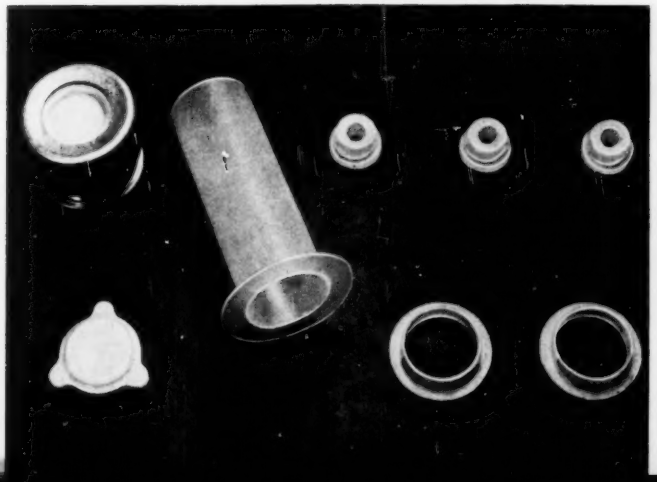
use of the plastic can often be justified on superior performance alone. Nylon gears operate more quietly than metal, need not be made to as close tolerances, frequently can be used without lubrication, and afford smoother power transmission with reduced wear. Fatigue resistance, resistance to permanent distortion, strength in thin sections, and chemical resistance are other nylon properties which add up to customer satisfaction.

Hudson's new pedal toe plate bumper seal is a case in point. When Hudson engineers set out to design a car with shorter wheelbase, it was necessary to conserve space within the engine compartment. By using pedal toe plate seals containing molded nylon washers, they cut the space required for the floorboard clutch and brake seals by one-half. As these washers move back and forth between the metal retainers to compensate for irregular paths of pedal shafts and varying foot pressure, they form an effective wear-proof seal against noise, dirt, and fumes from the engine compartment. In addition, they are heat resistant and unaffected by gasoline and oil.

A molded nylon gear 2¼ in. in diameter has been adopted for an electrically driven windshield wiper supplied as standard equipment on several makes of cars. The plastic gears not only gave better performance, but cost only about half as much as machined metal gears. The nylon gear operates quietly and can take the full thrust of the motor without damage in the event that the wiper blades freeze to the windshield.

A retractable motor-driven radio antenna for automobiles presented an entirely different type of problem which was solved by the use of extruded nylon rod and molded nylon gears. The design required a 4½-ft. rod to raise and lower the "live" members of the antenna—a unit sufficiently rigid to move the antenna up and down, yet flexible enough to coil into a 4-in. radius when the antenna was lowered. Good di-electric properties were another requirement. When the driver pushes the control button, a motor driven worm gear turns two nylon gears which rotate spring-loaded pulleys to raise or lower the antenna. The nylon gears, molded directly onto shafts, are quiet and long-lasting; both rod and gears have withstood up to 80,000 cycles without signs of wear. Insulating bushings in the assembly are of polyethylene.

Molded nylon parts in Ford include oil valve (left), brake pedal arm bushing (large part), horn blowing ring insulators (top right), and brake push rod bushing (lower right)



Water Pump Coupling

A small, intricately molded nylon water pump coupling overcame a serious operating problem experienced by Greyhound Corp. Source of the trouble was a two-piece steel coupling in diesel bus engines, connecting the water pump to a drive shaft from the blower. Mechanical failures were so frequent that as many as 200 busses monthly went to the repair shop for coupling replacement. After design modifica-

Courtesy Tennessee Eastman Co.

Butyrate handles for parking brake levers are injection molded over metal

Seat grab rails, overhead rails, and stanchions in bus are made more attractive and more pleasing to the touch with 1/32 in. coating of butyrate extruded over metal tubing

Convertible rear window made of vinyl sheeting is larger, safer than glass

Recently introduced auto battery has styrene case which is light in weight, acid resistant

Molded butyrate armrest bases, now used in most cars, have padded top surface which is often covered with vinyl sheet

Courtesy Tennessee Eastman Co.

Ford panel parts have white letters on black ring with acrylic cup to pipe light

tion failed to eliminate the difficulty, the part was changed to molded nylon. Results were outstandingly successful: out of 1000 such plastic couplings in service for a six-month period, only a few had to be replaced.

Door hinge bushings, replacing powdered metal bushings, and body parts such as garnish grommets exemplify the molded nylon components used on various G. M. cars. A number of auto makers are studying the possibility of using molded nylon parts for king pin bushings, usually made of steel-backed bronze. Tests indicate that a molded nylon bushing exhibits less wear on the bushing itself and reduced galling of the king pin shaft. Various types of ball-and-socket assemblies involving nylon are under study, and the results look encouraging.

Automotive electrical parts such as fuse holders, insulator bushings, grommets and sleeves, line connectors, and switch components represent another important new market for molded nylon. Generator brush holders are another example. One electrical component now molded of nylon in one piece formerly required a rather complicated assembly made up of a metal shell, a phenolic interior section, and an exterior rubber sleeve.

ACETATE AND BUTYRATE

All of the more successful automotive applications of cellulose acetate and cellulose acetate butyrate have been for interior use, such as instrument panel and radio control knobs; radio grilles; extruded trim strips and moldings; window regulator knobs; instrument dial pointers, faces, and bezels; dash panel overlays; decorative hardware inserts; parking brake handles; and steering wheels molded with a metal core. For such components, the cellulosics offer the speed and economy of injection molding, along with unlimited color range, durability for long service, and comfort to the touch.

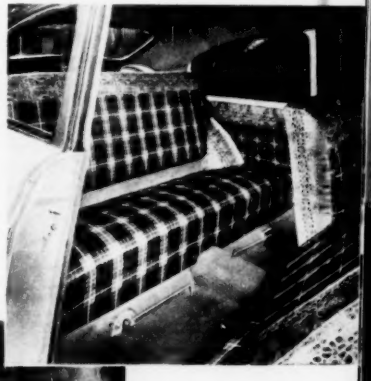
The two-shot molding technique adopted by Hudson several years ago for instrument dial faces, gear shift knobs, steering post medallions, and other interior parts is still being used by that manufacturer, but so far has not been widely adopted by the rest of the automotive industry. The method affords unusual decorative and lighting effects, eliminates finishing operations, and insures permanency of color in parts so molded.

Seat side panels used by Buick are formed of copolymer sheet material. The panels have inherent color and resist scuffing, moisture, and staining

A variation of this process was used by Ford for a group of instrument panel control parts on the 1951 models and carried over to the 1952 cars. These parts, produced by a three-shot process, have a main body of black butyrate with white butyrate molded-in letters and a clear transparent acrylic rim. Light from a concealed bulb is directed through the white lettering without glare.

Butyrate brake lever handles, currently used on Pontiac, Packard, and various Chrysler cars, illustrate an excellent functional application of this material. Molded directly over a metal crossbar at the end of the brake control lever, the handles can be made in any desired color, eliminate costly finishing operations which would be required with metal handles, and cannot come loose. Also, the butyrate handles are pleasant to the touch, both winter and summer, due to their low thermal conductivity.

A somewhat parallel application is the use of plastic-covered metal tubing for grab rails, stanchions, and baggage racks in busses and outside hand rails for large off-highway trucks. The plastic material, generally butyrate or vinyl, is extruded directly over the steel



Henry J has saran upholstery trimmed with embossed vinyl sheeting. Use of steam gun (left) keeps the material pliable during installation, insures tight fit

Interior of 1952 Kaiser has embossed vinyl arm rest cover, crash pad, trim

tubing, forming a tough, colorful 1/32-in. sheath which eliminates static shock, will not wear off despite long service, and is unaffected by perspiration. At present, approximately 15 companies are using this type of tubing for such applications, and more than a million ft. of the material is now in service on thousands of vehicles in the U. S., Canada, and foreign countries. A typical bus installation requires about 20 to 25 lb. of plastic if parcel racks are included, or 10 to 15 lb. if limited to grab rails and stanchions.

Steering Wheels

Steering wheels covered with injection molded butyrate currently represent about one quarter of all steering wheel production. Standard equipment on many of the higher priced cars, they are usually offered as an accessory in the lower priced field, where painted hard rubber wheels are standard equipment. In addition to their attractive color possibilities and pleasant "feel," the plastic wheels have no applied color to rub off and soil hands or gloves. One of the latest developments in plastic steering wheels is a Ford two-shot black and white accessory wheel which incorporates chrome plate metal trim where black and white halves join.

The most important new automotive outlet for cellulosic plastics since the steering wheel is armrest bases. The total volume of butyrate now going into this application already rivals that used for steering wheels, and may soon exceed it.

The molded butyrate armrest bases are usually combined with a top padding and surface of embossed vinyl sheeting, leather, cloth, or formed Royalite. Made in a variety of sizes, shapes, and colors to suit different makes and models, the bases are designed for strength, beauty, and utility. The moldings are cored out for reduced weight and internally ribbed for strength and rigidity. Unlimited color selection, excellent styling possibilities, simplified assembly and installation, and lower cost than metal-based armrests are among the advantages.

There is about 0.8 lb. of butyrate in the four armrests of a typical four-door sedan. Corresponding figures for a two-door model run somewhat higher—slightly over a lb. per car—because rear quarter armrests are not of the hand-grip type and contain more material.

COPOLYMER SHEETS

Numerous automotive components lend themselves ideally to fabrication from a durable sheet material which combines inherent color with attractive surface effects and requires no supplementary finishing before being placed in the car. Thus the relatively new styrene copolymer sheet materials, which are thermoplastic and may be easily formed without costly tools (see MODERN PLASTICS, 29, 71, July 1952) have already found a number of automotive uses and are slated for broader application in the future.

Available in a wide range of colors and surface treatments, these materials will readily accept paint if desired, and can also be covered with transfer-type veneers before the forming operation to produce wood grains and other special effects. Components fabricated of these materials withstand hard service and are quiet, moisture and stain resistant, easy to keep clean, and comfortable to the touch regardless of temperature extremes.

Automotive uses of styrene copolymer sheeting have included station wagon roof rails and wheel house covers for Plymouth station wagons. Rear panel seat backs for the same model form a section of the floor when the seat is folded down. The latter were color harmonized with vinyl sheeting for interior trim.

Buick is using a similar material for seat side panels in current models. The resilient plastic material does not scuff or lose its attractive appearance despite heavy wear at this point. The material has also been used for battery covers on cab-over-engine model trucks.

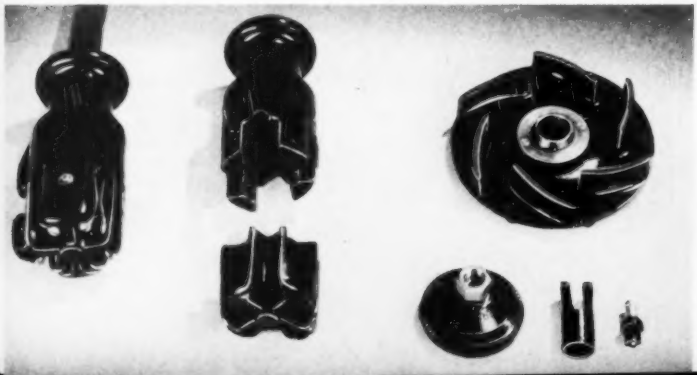
Crash Pad

One of the newest automotive applications developed for this material is in the Nash car. The completely redesigned Nash instrument panel, incorporating a "crash pad" of formed Royalite copolymer sheet was described in MODERN PLASTICS 28, 73, July 1952. Nash is also adopting Royalite trim pads on the back of the front seat.

Formed sheet materials of this type have been used with excellent results in some roof rail pieces for Chevrolet and Pontiac station wagons. In the opinion of a top General Motors stylist and materials coordinator, this plastic has considerable possibilities internally in place of certain imitation leather door pads.

(*Continued on p. 162*)

Molded phenolic auto parts include two-part brake plug (left), Cadillac water pump impeller (top right), and three carburetor parts (choke cover, vacuum piston, terminal)



Plastics Improve Mixers

TWO excellent examples of the use of plastics to improve the appearance and performance of quality electrical appliances are the recently introduced models of the Waring Blendor and the Hollywood Liquefier. Both of the appliances have motor housings molded of urea, but they represent two solutions to the same design problem.

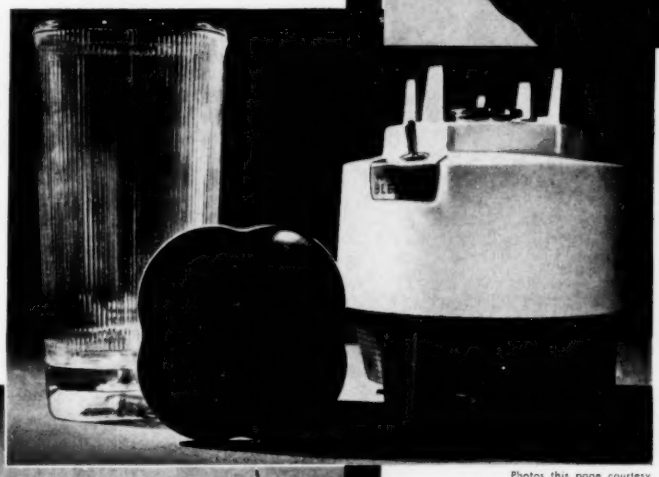
Both appliances are high speed mixers with sharp cutting knives which can be used to liquefy fruits or vegetables or mix cocktails, malted milks, or other drinks.

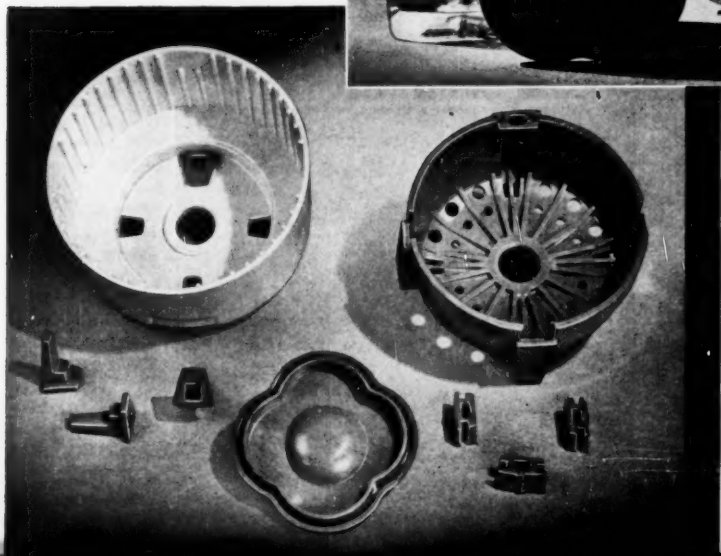
The Celebrity model Waring Blendor, made by Waring Products Corp., New York, N.Y., has a two-part housing molded of Beetle urea. Francesco Collura, who designed the new model Blendor, chose urea because it is unaffected by fruit acids, vegetable juices, or alcohol, and because it can withstand the heat generated by the motor. In addition, the urea housing weighs only 1 lb., 6 oz., or about one-fifth of what it would weigh if made of metal. It also has integral color, whereas the die cast zinc housings used in earlier models had to be painted or plated and were likely to become scratched.

The housing is designed so that the necessary ventilation ducts are hidden from view and protected so that they do not become dirt traps. The base of the housing, molded of gray urea, has four molded-in feet and has 33 ventilation holes molded-in the bottom surface.

The white motor hood fits over the base and rests on four elastomeric vinyl bumpers which absorb shocks, dampen vibration, and keep the two urea pieces far enough apart to allow the motor heat to escape. The space between the two urea pieces is divided into vertical ventilating ducts by ribs molded-in to the inner surface of the hood. The cover for the blending container is also molded of gray urea.

The blending container, which is made of glass, rests on top of the motor hood and is held firmly in place by four elastomeric vinyl lugs which extend through holes in the top of the hood. The molded





Photos this page courtesy American Cyanamid Co.

Parts of Waring Blendor, assembled at top, are (above) glass container, urea lid, and two-piece molded urea motor housing. Four extending lugs which grip glass container are vinyl

At left are housing components. Top: Motor hood (with one vinyl lug in place) fits over base and rests on four vinyl bumpers (one attached). Bottom: Lugs, back of lid, bumpers

All-plastic Liquefier (left) has cover and two-piece base molded of urea, and a cellulose acetate container with ribs and measuring markings molded-in

vinyl lugs are cored to accommodate metal stiffeners.

The urea parts of the Waring Blendor are molded by Watertown Mfg. Co., Watertown, Conn. The eight vinyl parts, which match the gray urea pieces in color, are by Wilpet Mfg. Co., Kearney, N. J.

Urea for 14 Years

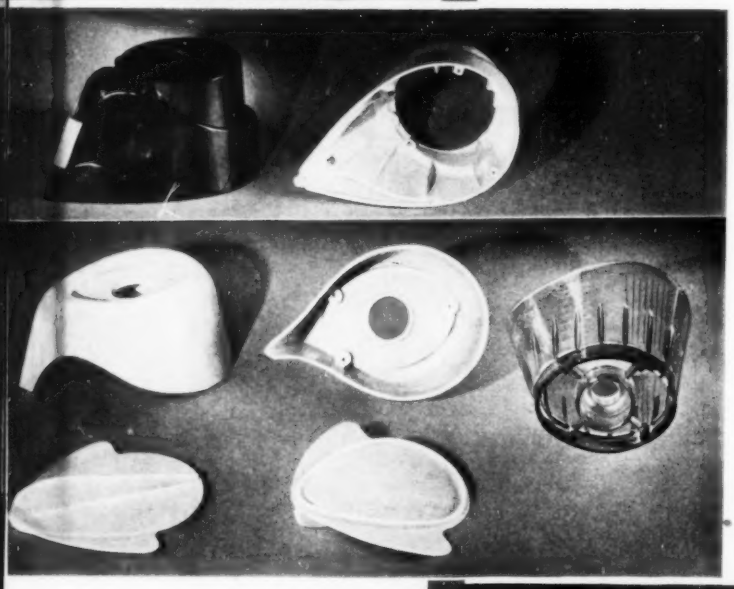
The Liquefier made by Hollywood Liquefier Co., South Pasadena, Calif., has had a molded urea base since the appliance was first introduced in 1938. Recently the manufacturer also adopted a molded plastic container; a glass one was used on earlier models.

The new container, which is molded of transparent Tenite or Lumarith cellulose acetate, has a streamlined, tear-drop shape which makes it easy to grasp and provides it with a built-in pouring spout. Vertical ribs to insure a non-slip grip and graduations in cups and ounces are molded-in.

With an average wall section of about ⅛ in. the container is virtually unbreakable. Molded-in ribs in the bottom enable it to take the knife mechanism's vibration.

The motor housing, molded of Plaskon urea, consists of a bottom piece, an upper piece, and a small adjustable nose-piece which is screwed to the narrow end of the tear-drop-shaped bottom piece. The container rests in a molded-in depression in the top of the upper piece. The container lid is also molded of urea.

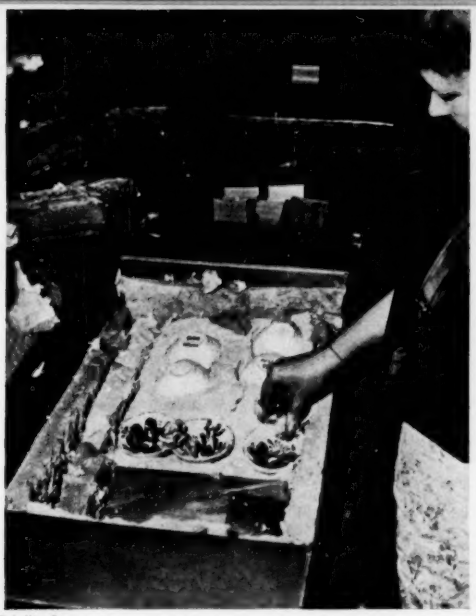
The container for the Liquefier is molded by Modern Plastic Co., Los Angeles, Calif., and the urea parts by Reinhold-Geiger Plastics, Inc., Los Angeles.



Above: Outside and inside views of motor housing base with adjustable nose piece; upper part of housing; and lid. Container has ribs molded-in the base

Courtesy Tennessee Eastman Co.

Durable acetate container (right) has walls ⅛ in. thick. It is molded in tear drop shape which is easy to grasp and provides a built-in pouring spout



All photos courtesy Bakelite Co.

Phenolic foam, pre-cut in convenient slabs, is hand-cut to fill package space around heavy fragile items. Use of foam reduces packing time

Light weight dishes or glassware are simply pressed into slabs of phenolic foam to form cavities which keep them from shifting in transit

Shipped in Phenolic Foam

LIGHT-WEIGHT glassware, ceramics, and similar fragile articles can be shipped safely and economically by using foamed phenolic as a packing material instead of shredded paper or straw. The material, shown by Bakelite Co. at the National Packaging Exposition, has been successfully adapted and tested by the specialty mail order house of Miles Kimball Co., Oshkosh, Wis.

This first large-scale use of phenolic foam as a commercial packing material has resulted in savings in breakage and postage and, consequently, in reduced costs for handling of claims and lower insurance costs. Packing time was also reduced and customer reaction to the appearance of the finished package is favorable.

Bakelite phenolic foam, which is produced in five-ft. cubes, has a density of between 0.3 and 0.4 lb. per cu. foot. Thus it is about one seventh the weight of top grade shredded paper packing or about one tenth the weight of the ordinary shredded newsprint commonly used for packing. The five-ft. cubes of foam can be lifted easily by one man.

In addition to its light weight, advantages of the foam are flame resistance, high resilience, attractiveness and neatness, thermal insulating properties, and the ease with which it can be handled.

Blocks of foam are made from Bakelite phenolic resin in liquid form, which is briefly beaten to stir in air, mixed with an acid catalyst, and poured into a simple form. The mixture quickly expands to at least 200 times its original volume. This entire operation takes only 45 seconds. The block is discharged by opening the mold and stripping from the block the Kraft paper which is used to line the mold to insure easy separation.

Packing Procedure

The block can readily be cut into convenient sales with an ordinary timber saw. The slabs of phenolic foam are packed into a carton and cavities to cradle the objects to be shipped are made by simply pressing the objects into the foam. Because of a grain effect produced in the expansion process, heavy items are packed parallel to the grain for maximum compressive strength. Fragile glassware and similar items are pressed into the end grain to form deep cavities which prevent shifting of the objects.

Five-ft. cube of foam is so light that it can be lifted by one man

What's Being Done With the THIN RIGID SHEETS

No. 2 of a Series of Articles on the Economics of Plastics Sheet Forming—1952

Courtesy Celanese Corp. of America

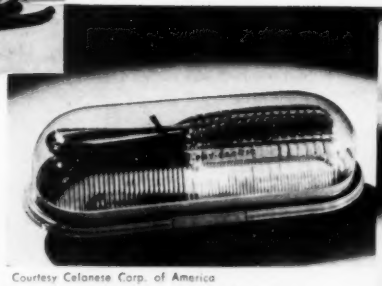
Eye shields and other safety devices are formed of clear acetate sheet

WHEN Hyatt's infant plastic, cellulose nitrate, was first produced in sheets, the science of thermoplastic sheet forming started to develop. And many of the delicate techniques were then established in principle, requiring only adjustment in detail to the needs of other thermoplastic sheets to come.

For two decades, dressing tables all over the world displayed brushes and hand mirror sets made of decorative cellulose nitrate sheet, heat and vacuum formed and then applied over composition or wood cores. Applications following from the same techniques were hamper tops, toilet seats, and ping pong balls —applications which today enjoy tremendous volume.

Thus the principles of thermoplastic sheet forming have been long established, but broadened applications of these principles made possible by improved devices and newer thermoplastic rigid sheets have brought about a whole new science of sheet forming.

As an example, it was found more than 30 years ago that the "plastic memory" of thermoplastic material was a very bothersome factor. Sheet cellulose nitrate was produced by laminating a block of calendered sheets, slicing a thin sheet



Courtesy Celanese Corp. of America

Package for brush and comb set has opaque acetate sheet platform, formed acetate lid

Courtesy Bishop Publishing Co.

Illuminated sign has formed letters which project through the hardboard face

Courtesy Chicago Plastic Products Co. Div., Dr. Scholl Mfg. Co.

Formed copolymer sheet tray has disposable liner made of thin acetate

Large Santa Claus sign is formed from sheet material at rate of 95 per hour

Courtesy Bishop Publishing Co.

cross-grain with a "sheeter," and then press-polishing. But when this press-polished sheet was placed in an oven, or in hot water, or over a hot plate, if the heat were not carefully controlled, "sheeter lines" caused by the slicing knife would reappear in the formed product, wiping out some of the advantage of the press polishing.

When extruded sheet cellulose acetate and butyrate were developed, the problem became one of counter-balancing strains set up during the extrusion process—an element not encountered in cast sheet.

Each of the "thin" rigid thermoplastic sheets (the usually thicker acrylics are reserved for the third article in this series) has its own softening point, its own memory distortion factor, its own modulus of elasticity, and its own dimensional stability factors . . . its own problems.

Inexpensive Equipment

There is a basic economy in thermoplastic sheet forming not encountered in any other type of plastics fabrication. Where a job can be done both ways, even the most expensive machine for vacuum forming costs but a fraction of what it would cost to buy any kind of injection machine to produce the same end product. Sheet forming mold or die costs are picayune in comparison to mold costs for injection or compression operations. Sheet forming cycles today are fairly rapid on all materials. Any loss of economy is occasioned through rejects and through bad sheet area estimating, which results in too high a percentage of trim. On extruded sheet materials, this waste problem is lessened, because those thermoplastics may be reworked.

Decoration has been applied to formed and fabricated sheet thermoplastics of all kinds for many years, but only within the past half decade has the principle of preprinting in the flat and then forming come into the general use. Pioneers in the use of this method were Aero Service Corp., Philadelphia topographical map makers, and Stanley Wessel, Chicago, Ill., both of which used Vinylite in the process.

Acetate

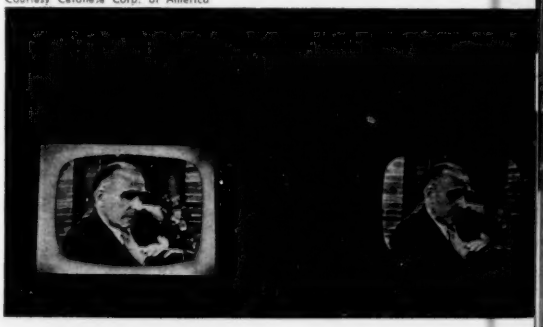
Following nitrate came cellulose acetate, and its first application, in transparent form, was to packaging. A good example is an opaque drawn platform and transparent drawn acetate dome, constituting a package for Pro-Phy-Lac-Tic "Jewelite" comb and brush sets.

After packaging came dial faces for clocks and meters, where the formed sheet acetate replaces glass, providing an unbreakable transparent shell which is dust-proof. Still in transparent version, there followed the whole field of safety equipment—eye shields, goggles, etc. Pulmosan Co., New York, N.Y., one of the specialists in the field, developed, with the help of Celanese Corp. of America, satisfactory techniques for drawing sheet acetate with a minimum of optical distortion.

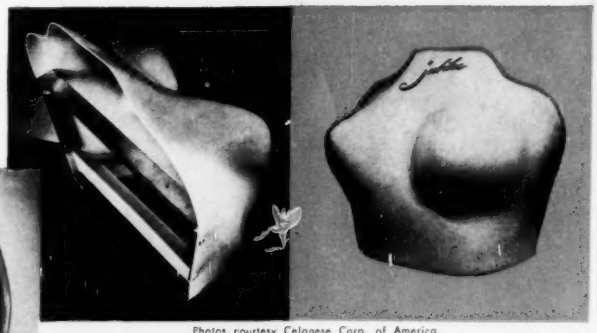
One of the newest jobs, in sheet acetate, and one which takes advantage of the basic economy of the material, is a liner for military hospital trays. The trays themselves are made of heavy copolymer sheet, while the disposable liners are acetate. Out of this development naturally came a barbeque tray, made by Chicago Plastic Product Co. Div., Dr. Scholl Manufacturing Co.

For some time, the whole idea in rigid acetate sheet manufacture was to get perfectly transparent material, and this was generally cast,

Courtesy Celanese Corp. of America



Better television viewing results from use of back-lighted tube mask formed of acetate sheet



Photos courtesy Celanese Corp. of America

Use of formed thermoplastic rigid sheets often involves engineering of supporting frames as well as heat outlets when lighting is used

Courtesy American Merri-Lei Corp.

Pattern heating of sheet is used to obtain 70% draw in party hats and still maintain sufficient wall thickness in all parts of piece

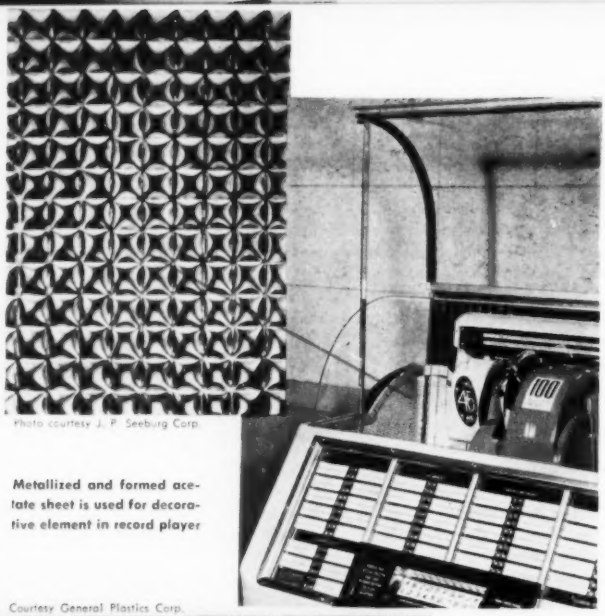
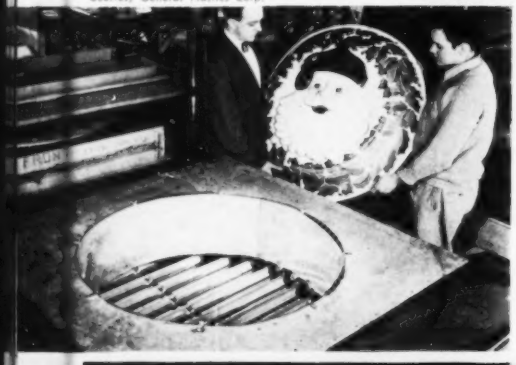


Photo courtesy J. P. Seeburg Corp.

Metallized and formed acetate sheet is used for decorative element in record player

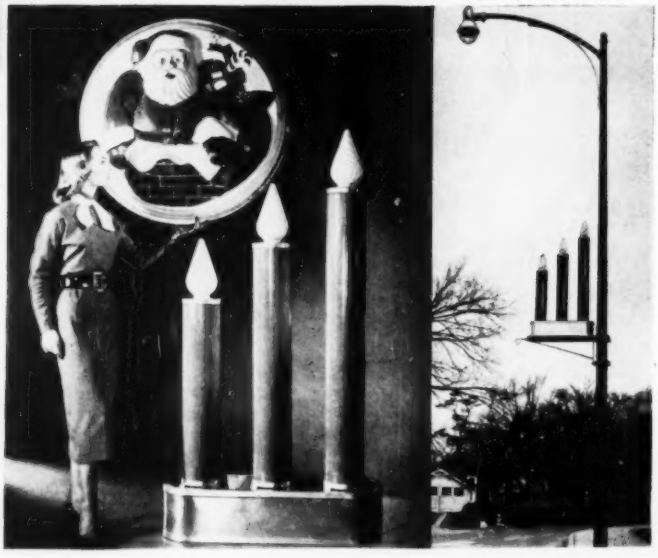
Courtesy General Plastics Corp.



Huge illuminated Christmas street decoration is drawn after heating in an oven. Printing is done on flat sheet

Triple candle 5½ ft. high is formed from butyrate sheet and is lighted from within

Courtesy Tennessee Eastman Co.



but as extrusion techniques and compounding for extrusion were improved, it became possible to dry extrude high-quality transparent acetate sheet at a much lower cost than cast sheet. It also became possible to extrude colored and translucent acetate sheet. When that happened, new markets opened rapidly.

Probably the most important of these new markets was the display field, where back illumination made three dimensional formed acetate into signs that competed most favorably with punched drawn metal signs, wooden signs, and molded plastics signs. For short runs, particularly, the sheet thermoplastic paid off. An example of this is the Sears, Roebuck & Co. sign made by Bishop Publishing Co., Chicago, Ill., from extruded cellulose acetate sheet.

Printing Techniques

Of course, this whole sign field has only become economically practicable for long runs since the development of printing techniques. Prints are made in distortion prior to forming and, while the dies themselves are not expensive, the engineering that goes into obtaining three-dimensional shapes with flat printing formed into perfect contour registration, is considerable. Bishop uses acetate, butyrate, and thin acrylic. Its techniques have been developed by personal experience. The Sears, Roebuck & Co. sign, for example, has the plastic material formed right through cut-out letters in the hard-board face of the sign, this being accomplished by simultaneously laminating the plastic insert to the hard-board in a single operation, using an adhesive between the two parts.

Bishop's approach to economics is illustrated by a large illuminated acetate Santa Claus sign, which is made at the rate of 95 per hr., including pre-heating, forming, and removal from press.

Translucent Lumarith acetate sheet is used by Sylvania Electric Products Inc. in the manufacture of the famous Sylvania Halo-light, which is literally a back-lighted translucent mask or frame to provide "surround-lighting" around a television tube.

Opaque colored acetate has found widening markets in the merchan-

dise display field. Literally dozens of companies are engaged in this type of work. The displays are fairly indestructible, washable, and remarkably low in cost. For example, a brassiere form display is made by Plastic Artisans Inc., White Plains, N.Y., for United Mills Corp., out of flesh-colored sheet Lumarith.

As pointed out in our July article, when deep vacuum forming is to be done on thin sheets, pattern heating is a must to make possible predetermined thicknesses of drawn material at every point in the form. A line of party hats made by American Merri-Lei Corp., New York, N.Y., from 0.015-in. acetate, illustrates this point. Normally, a 50% draw on such thin material is considered the maximum practical. But Merri-Lei got a 70% draw on this job by using the pattern heat technique in the Sill machine described last month. The company was able to keep the wall thickness at the crown part of the hat at 0.005 in. by this method, while without it, wall thickness at that point got down as low as 0.00015-inch.

First in the acetates and now in other materials are metallized formable rigid sheets, which are used to produce spectacular effects in displays, in packaging, and elsewhere. Coating Products, New York, N.Y., using both Kodapak and Lumarith acetate in continuous roll form, metallizes the material and then embosses it. The new J. P. Seeburg Select-O-Matic automatic phonograph features this material behind the record rack, producing an effect otherwise obtainable only with embossed plated metal, which would be too heavy and too expensive for the application.

Butyrate

Cellulose acetate butyrate is produced in powder form by Tennessee Eastman, but is dry extruded into sheet form by several companies, some of which, like Joseph Davis Plastics Co., Arlington, N.J., sell it to fabricators; others, like General Plastics Corp., Marion, Ind., extrude it for their own fabrication use.

Davis extrudes acetate, butyrate, ethyl cellulose sheet in thicknesses from 0.005 to $\frac{1}{8}$ in., and in widths up to 60 inches.

One of the biggest companies in the formed sheet butyrate field is General Plastics Corp., with a fabulous line of vacuum formed Tenite II out-door illuminated lighting units, for street decoration at Christmas and on other festive occasions. Butyrate is the favored material for this application because of its ruggedness and weather resistance, its permanent luster and light weight, and its compatibility with inks and paints. General Plastics developed its own radiant heating ovens and built special presses to

(*Continued on p.* 184)

Attractive and durable translucent window shade 17 by 36 in. for use in bus is formed from butyrate sheet material flexible enough to be rolled up

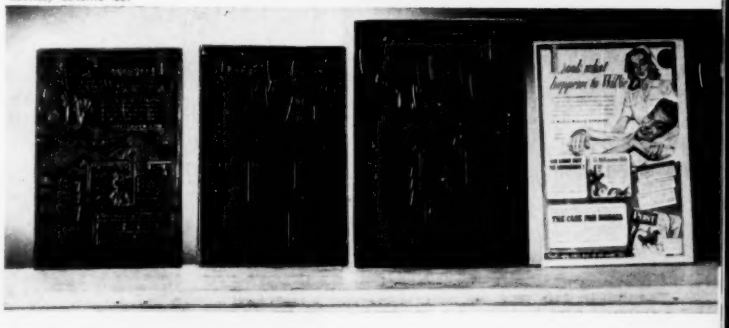
Photos courtesy Midwest Plastic Products Co.

Courtesy W. L. Stensgaard & Assoc., Inc.

Decorative panels are formed of vinyl copolymer decorated on both sides

In electrotyping, formed sheet is plated; plating is then heavy-metal backed

Courtesy Bakelite Co.



Nursery shown in movie uses plastics in drapes, Venetian blinds, baby bath, play pen pad, crib mattress, and chair (not shown)

Airplane in which most of action takes place has plastic wall covering and drapes. Food is served on plastic plates; blankets are made of Dynel

"FLIGHT TO THE FUTURE"

Color motion picture available for presentation to consumer audiences

shows the various things plastics are used for and why they are used

ONE of the most powerful tools for consumer education which the plastics industry has ever had is a new 16-millimeter, all-color motion picture entitled "Flight to the Future." The movie which was produced by Bakelite Co., is now available to organizations in the plastics industry and will be released to private or public organizations outside the industry on September 1.

"Flight to the Future" is designed to give the layman who views it an idea of the diversity of plastics, the things plastics are used for, and the reasons why plastics are used. But instead of the usual illustrated lecture or commentary-type presentation, the movie is written as a lively and entertaining story with all the information to be presented woven into the continuous dialogue. The picture runs about 37 minutes.

Bakelite is making the film available to schools, colleges, clubs, service organizations, PTA's, or any other interested groups upon request. The only cost to the group showing the film will be a nominal charge to cover the cost of shipping the film to and from the nearest distribution point. Bookings will be handled through Modern Talking Picture Service, Inc., 45 Rockefeller Plaza, New York 20, N.Y., which has 27 branch offices and exchanges throughout the United States. Requests for bookings should be made directly to the distributor rather than to Bakelite Co.

The eight principal parts in the movie are played by professional Hollywood actors and actresses, including Lyle Talbot, John Eldridge, and others whose faces are familiar to movie goers. The cast also includes 20 bit players and a number of extras.

Seven indoor sets, including the

Vinyl inflatable toys and wading pool are shown in scene at country club pool. Cups, tumblers, serving trays, and iced tea spoons on table are also molded of plastic

interior of a transport plane, were constructed and furnished especially for shooting "Flight to the Future." Plastics materials and plastics applications were used extensively in constructing and furnishing the sets. Scenes were also shot in 25 different locations in California, Chicago, New York, and the Bound Brook, N.J., plant of Bakelite Co. In the course of the film, over 1000 plastics products and applications are shown.

The Story

"Flight to the Future" opens as the principal female character, an airline stewardess, is awakened by a phone call informing her that she has been assigned to a special charter flight. Many plastics items are visible in the bedroom, living room, bath room, and the kitchen of the girl's apartment as she is shown getting dressed, having breakfast, and leaving for the airport. But nothing is said about these items at this point in the picture.

At the airport, the stewardess discovers that the charter flight has only one passenger, initially, and that three others are to be picked up en route. After take-off, she gets into conversation with the first passenger and discovers that he is a plastics manufacturer. In the discussion which follows, the stewardess learns a lot about how, where, and why plastics are used. Because the stewardess "knows nothing about plastics," her conversation with the manufacturer gets down to fundamentals and is simple enough for the average audience outside the plastics industry.

The discussion is varied as the plane makes stops to pick up its three other passengers who turn out to be a plastics engineer, a designer, and an old-timer in the industry. The talks about plastics are also cleverly interspersed with elements of humor, human interest, and even suspense.

The flash-back technique is used to point out the many plastics items used in every-day life. Some of the products are simply mentioned; others are discussed in some detail and their advantages, such as easy cleanability, actually demonstrated. Although the main emphasis is on consumer applications, industrial uses to which plastics can be put are not ignored.

Public Relations Job

One thing particularly worthy of note is the fact that the picture does not attempt to do a commercial selling job for any particular type or brand of plastics. It covers almost the entire range of plastics materials and applications. It is thus a public relations job for the entire industry. The philosophy which lies behind the production of "Flight to the Future" is best indicated by the following excerpt from the handbook on the film prepared for Bakelite salesmen: "The more that potential users of plastics, either industrial or consumer, both present and future, know about the advantages of plastics, the better it is for all of us."

Color movie starts in girl's bedroom . . .

. . . shows her living room full of plastics . . .

. . . kitchen with vinyl floor and upholstery . . .

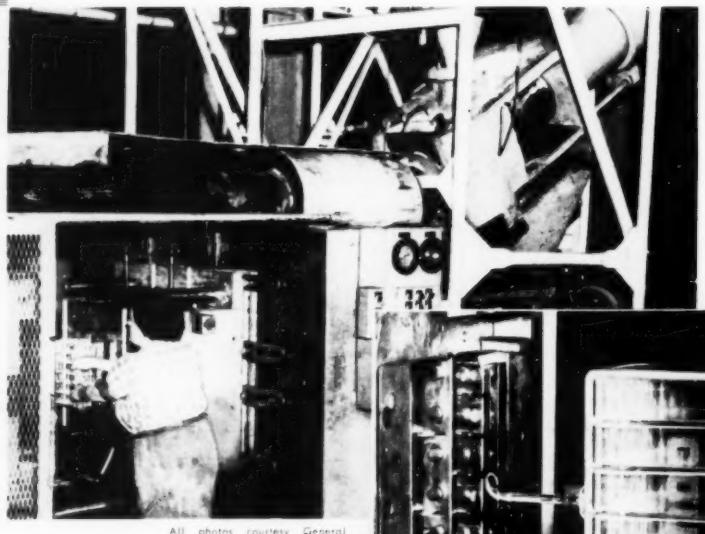
. . . and various plastics gifts for Christmas

Bathroom of airline stewardess' apartment has plastics in shower curtains, window curtains, wall tile, flooring, and fixtures as well as the hair curlers girl is using

All photos and color plates courtesy Bakelite Co.

One-piece Molded Styrene

BATTERY CASE WEIGHS 8½ POUNDS



Styrene battery case, weighing 8½ lb., is molded in one piece on a 300-oz. Watson-Stillman press equipped with a pre-plasticizer; the mold weighs 7 tons

All photos courtesy General American Transportation Corp.

Punch segments (right) form 6 separate compartments of case and are designed to keep taper to 0.004 in.-per-in. or less; in mold cavity (left), 18 holes are cored on each side of case, 2 on its ends

ONE-PIECE battery cases have been molded of plastics for years, but mostly in small sizes because of the many limitations imposed by machine capacity and the mold design problems encountered when great depth of draw is required. Thus, the molding of a case weighing $8\frac{1}{2}$ lb. and having dimensions of approximately $8\frac{1}{2}$ in. wide by 11 in. long by 12 in. high, offered many challenges to the molder and mold maker alike.

Forerunner of the new case was a fabricated unit of the same size, designed in 1947. This was built by cementing together cut sheets of acrylic. Next step in the development was a two-piece styrene case, in which symmetrical injection molded halves were joined by cementing. With this design, and with the split line running around the 11-in. dimension, the manufacturer was able to circumvent the problems of the 12-in. draw which would have been required for one-piece molding. The draw in the two-piece assembly was roughly half of the $8\frac{1}{2}$ in. dimension or $4\frac{1}{2}$ inches.

Early in 1951 General American Transportation Corp., Chicago, Ill., was commissioned by Gould National Batteries, Inc., Depew, N. Y., to design a mold and produce the big battery case as a one-piece injection molded item. The old problem of deep draw, minimum tapers, and the requirement of six compartments or cells as integral parts of the molding were still present. But it was felt that, with a large new injection machine available, the application of the latest developments in mold and molding techniques should make the job feasible.

The design of the mold, it was agreed, would be one of the most important factors in successfully producing an item of this type. As a result, the normal General American procedure of a meeting of the Mold Design Panel, which includes production engineers, design engineers, production supervisors, and sales engineers, was expanded to include outside design assistance. In

Produced on a 300-oz. machine, in a mold weighing

7 tons, cases are annealed to relieve stresses

examining the history of other smaller battery case molds, it was found that Guy P. Harvey and Son Corp., Leominster, Mass., had a considerable background of experience in designing and building molds for products of this type and, furthermore, that this firm held patents on mold design which would allow for the production of tools with a minimum of taper. Consequently, a Harvey representative was invited to attend the general discussion on the basic design of the mold.

When the mold was being designed, the following features were incorporated: 1) There was no vertical taper on the outside walls of the case. 2) The taper on the punch segments was 0.004-in.-per-in. or less. 3) The mold was designed to operate on a 300-oz. Watson-Stillman machine. 4) Provisions were made to provide for injection pressure release if necessary. 5) The part was gated at six points in the bottom of the case directly opposite the exact center of the punch segments. 6) All holes were cored where possible. 7) All threaded holes were produced with molded-in threads where possible.

The resulting tool as produced by Harvey was a rather complicated mechanism. In principal it operated with a butterfly type of mold cavity. The entire mold weighed approximately 7 tons. There were amazingly few bugs in the mold design, and production was obtained in a remarkably short time. The resultant product when molded in Koppers P-8 high temperature styrene weighs 8.5 lb. (136 ounces).

Thirty-six holes are cored, 18 on each side of the case; and two threaded holes are cored on the ends of the case. An additional set of six holes is drilled in the side of the case, the gates are machined, and some sanding operations are performed to provide a flush surface for cementing on the Gould assembly line.

Molding operations are performed on a 300-oz. Watson-Stillman machine equipped with a pre-plasticizer. The large overhang of the mold cavity necessitated the use of slide supports which were anchored to the cavity block resting on the ways of the machine.

Two major problems in operating this mold were those of accurately controlling the material feed and the mold temperatures. Material feed control was deemed vital in order to prevent even the remote chance of over-pressuring. Flashing of this mold, of course, would be disastrous but even slight over-pressuring due to overfeeding will contribute to serious internal stress conditions. Therefore a weigh feeding device manufactured by B. F. Gump Co., Chicago, Ill., was installed and used successfully.

Mold temperature control contributes to ease of filling the mold and of extraction of the piece, as well as to the production of stress-free moldings. The huge masses of steel in these molds require lengthy preheating before molding operations can commence. Heat loss from mold to press platens was a problem answered partially by use of surface ground sheet insulation.

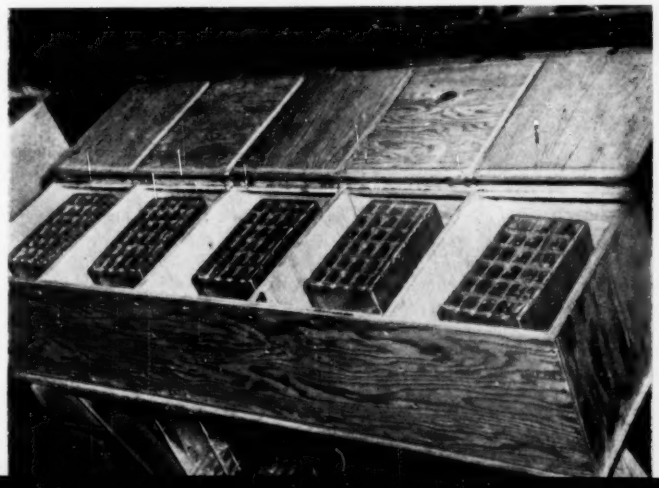
The history of this type of battery case indicated at the start that it would be extremely important to design and develop satisfactory annealing techniques which would insure a minimum of internal stress in the molded part. It was felt at the outset that one of the most important factors in annealing a part of this size and weight would be to get the molded part into the annealing system with a minimum of delay after it has been removed from the mold.

Annealing temperatures were determined experimentally by raising the annealing tank temperatures to a point where the parts became distorted and then reducing this temperature about 7½°.

The parts are annealed for two hr., after which they are removed and placed in a well-insulated wood cabinets. This allows for slow cooling. Upon removal of the part from the cooling boxes the pieces are still warm, and they are then placed immediately in their cardboard shipping containers so as to again reduce the possibility of thermal shock.

Testing for proper annealing is done using the technique of dipping the molded and annealed part into a bath of ASTM normal heptane for two minutes. The part is then removed from the tank and allowed to drain. Frequent examinations are made after removal of the parts from the heptane bath to observe whether any strain release is evident in the form of crazing, checking, or cracking.

After 2 hr. annealing process, cases are placed in closed insulated wood cabinets to allow for slow cooling; upon removal, cases are packed in cardboard shipping containers



Picnic Plates Vacuum Formed

Formed compartmented plate is light in weight, but durable and completely reusable. Integral coaster has ridges to prevent glass from sticking. Plate is 10½ by 10½ inches

PLASTIC sheet is hot when it comes out of the extruder. Plastic sheet has to be hot in order to be formed. These two well known facts point to an obvious conclusion: the best place to form plastic sheet, if the length of the run permits, is at the output end of the extruder. This eliminates the need for cooling, storing, transporting, and reheating the sheet. Furthermore, trimmings, rejects, and other scrap can be fully utilized; they can be reground and immediately put back into the hopper of the extruder.

An interesting application of this principle is the set-up at Federal Tool Corp., Chicago, Ill., for producing picnic plates from extruded styrene copolymer sheet. The 10½ by 10½ in. compartmented plates are produced on a continuous basis at a rate of 700 per hour.

Production Process

The Styron 475 high impact material is fed into the hopper of a 3½ in. National Rubber Machinery extruder. The output of the extruder is a 16 in. wide flat sheet from 0.025 to 0.030 in. thick. As the sheet emerges from the extruder, it is carried along on a special flexible belt.

An operator stands beside the belt and manipulates the single-cavity female vacuum forming die which shapes the plates. The die, which is made of magnesium, weighs about 27 lb., but is counterweighted so that the operator can handle it as though it weighed nothing. The die has a handle grip on top and three hose lines connected to it: a vacuum line and cold water feed and return lines.

The operator places the die on the still-hot moving web of material a short distance from the extrusion die and moves it along with the web for about a foot. This requires from three or four seconds. The operator then lifts the die, swings it back toward the extruder, and repeats the process. About one in. of space is left between successive impressions.

The web of material then passes down a gentle slope across a fixed table. Two large fans placed alongside the conveyor at this point cool the plastic material rapidly.

From this table, the formed plastic sheet passes to a punch press, which cuts the individual plates from the sheet. The speed of the extruder and the punch press are synchronized so that there are no delays or jam-ups. However, the sheet material is flexible enough to arch slightly if the extruder gets a little ahead of the punch press.

Upon removal from the punch press, the plates are labeled and packed. No finishing operations of any kind are required. The trimmings from the punch press are reground and fed back into the hopper.

The formed plates are extremely light in weight and highly resistant to breakage. The material is so strong, and so flexible, that it has to be bent almost double before it will break. The plates are colorful, washable, and nest compactly for storage.

Moreover, the plates are extremely economical to produce because they can be made with little more equipment and labor than that required to extrude, cut, and stack flat sheet material. The forming die used cost in the neighborhood of $1500 as compared with an estimated $6000 for a similar single-cavity injection die.

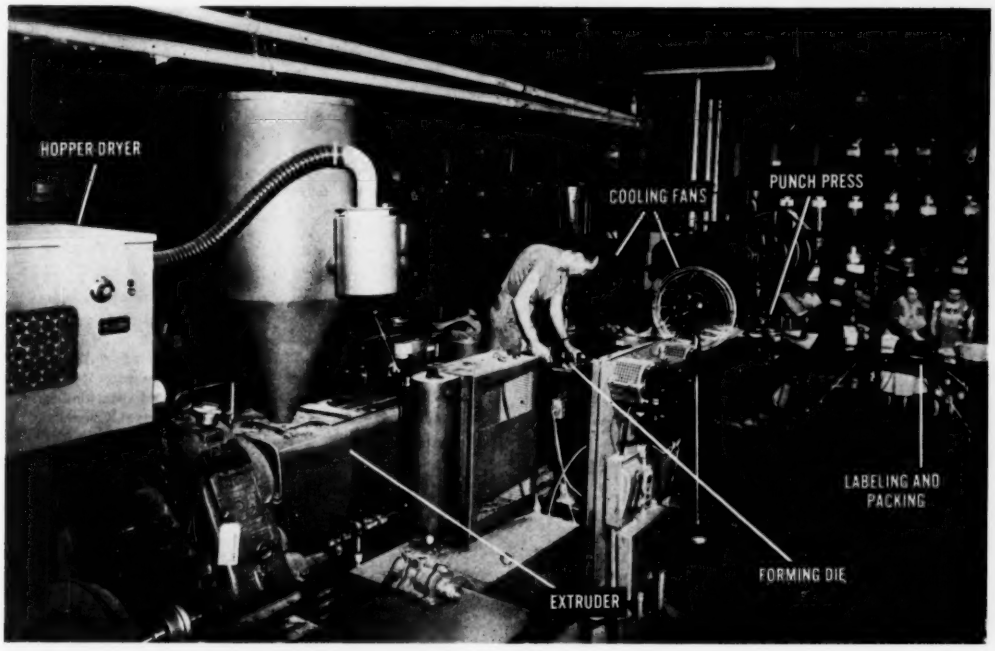
Equipment Used

The 3½-in. National Rubber Machinery extruder used in the Federal Tool set-up has a gear ratio of 36.6 to 1. It is equipped with a 9 kw. capacity D & W Hopper-Dryer made by Thoreson-McCosh Co., Detroit, Mich. This unit, which is connected to the hopper by a flexible tube, draws air in through a filter, heats it, and pumps it into the hopper.

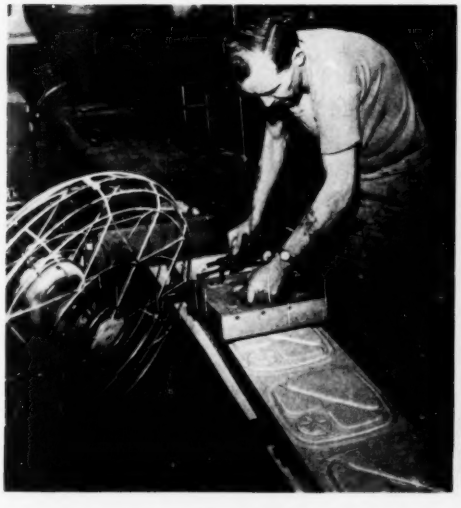
The vacuum for the forming die is provided by a Stokes Microvac Pump with a 5 hp. motor and a capacity of 115 c.f.m. at 385 r.p.m. The punch press used is a conventional type press with 3½ in. stroke made by Federal Press Co., Elkhart, Ind.

Federal Tool expects to improve the economics of the process further by such refinements as automatic equipment to place and move the forming die. Federal also expects to produce other formed items in the same manner. Because of the simplicity and economy of the method, it is safe to predict that many other molders, extruders, and/or sheet fabricators will soon be forming sheet at the extruder's output end.

Set-up for continuous production of styrene copolymer plates is economical because sheet material is formed while still warm as it emerges from extruder



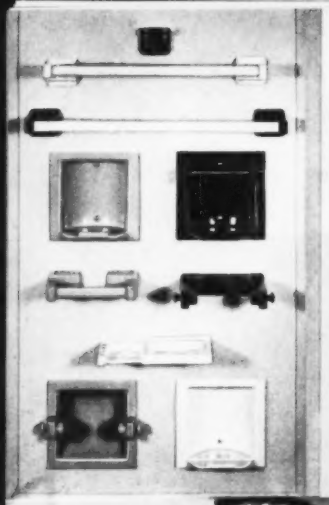
Extruder produces flat styrene copolymer sheet 16-in. wide. As sheet emerges from extruder, operator places single cavity vacuum forming die on the still-hot sheet. Continuous web of formed plates is carried to punch press where plates are die-cut from the sheet



Magnesium forming die weighs about 27 lb. but is counterweighed so it can be handled easily. Fans cool formed plates

Punch press cuts the individual plates from the formed sheet. After removal from punch press, plates are labeled and packed. No finishing is needed

plastics products



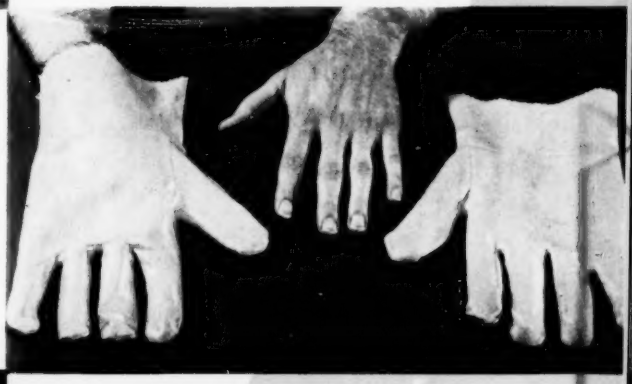
Left—Robe hooks, tissue holders, recessed soap dishes, and other bathroom fixtures are molded of colorful Lustrex styrene. The smooth design of the fixtures gives them a modern appearance and makes them easy to keep clean. Their lustrous surface is chip-proof and immune to rust or corrosion. Manufactured by Jayson Products, Inc., 1914 Hooper Ave., Los Angeles, Calif.

Left—Youngsters quickly learn to play tunes on the Swing-a-Tune, an eight-reed instrument made of Bakelite styrene. Notes are selected by swinging the bottom half of the instrument until the proper reed is lined up with the air outlet of the mouthpiece end of the instrument. Swing-a-Tune is made by Magnus Harmonica Corp., 439 Frelinghuysen Ave., Newark 5, N.J.

Right—Attractive, durable threshold is made of Strata-wood, a material made by impregnating wood veneers with phenolic resin and curing them under heat and pressure. The material, known as compregnated wood, retains the beauty of the natural wood but is far harder, denser, and abrasion-resistant. It also has a high gloss. The threshold is available in 4-, 5-, and 6-in. widths in various lengths with the top surface either plain or grooved. Made by The Formica Co., Cincinnati 32, Ohio

Left—Louvered cylinders molded of Tenite II cellulose acetate butyrate can be tapped into ¾-in. holes in house siding to allow air to circulate and thus eliminate moisture which causes paint to peel. The one-piece butyrate cylinders are molded by Industrial Plastics, Inc., 1351 W. 73rd St., Cleveland, Ohio, for Vent-O-Wall Co., 16201 Elsienna Ave., Cleveland

Left—Colorful lawn ornaments which are unaffected by exposure to weather are made of acrylic. Colors are silk-screened on. Line includes Dutch boy and girl 16 in. high, family of ducks, pair of rabbits, penguin, and ferocious looking bull dog with word "beware" below it. All have points which can be pressed into the ground. The ornaments are made by Union Products, Inc., 15 E. 26th St., New York, N.Y.

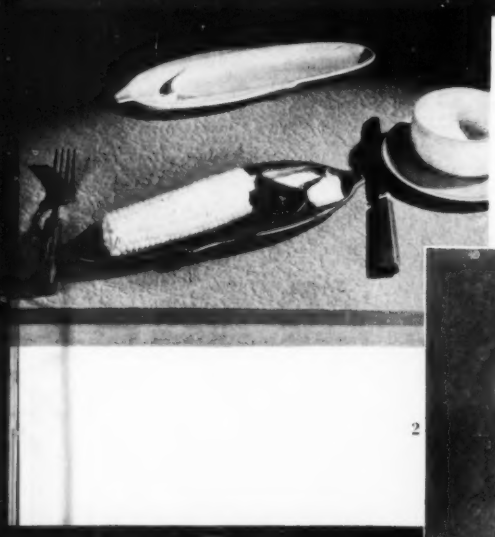


Right—Work gloves coated with Vinylite resin have free-swinging thumbs which permit them to be worn on either hand. The wear is thus distributed and the gloves outlast four pairs of conventional gloves. A nonslip finish on the vinyl coating assures the wearer a strong grip. Made by Washington Glove Corp., 106 N. Water St., Milwaukee, Wis.

Left—Three-way Howdy Doody pin-up lamp has semi-cylindrical shade made of glass fibers impregnated with vinyl resin. The lamp is 10 in. high and has two bulbs and a four-way switch so that either bulb can be used alone or both can be on at once. The shade is laced with vinyl strip and is decorated with a number of Howdy Doody characters. Manufactured by Project Fixture Mfg. Co., 212 Beach 87th St., Rockaway Beach, N.Y.

Right—Woman's raincoat made of pique-embosed 4-gage vinyl film has two-color applique rose design heat sealed to the collar. All seams in the coat are heat sealed and patch pockets are sealed on with a simulated saddle stitch. The coat is manufactured in three sizes in rose, blue, green, gray, and pearl white by Texicote, Inc., 573 Broadway, New York 12, N.Y.

PLASTICS *Merchandising**



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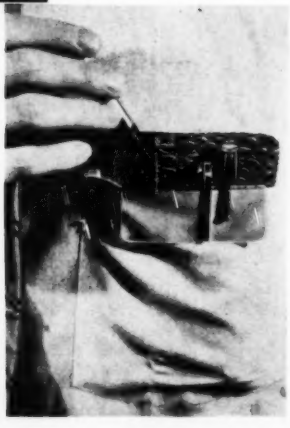

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1 **Corn server**—Dish shaped somewhat like an ear of corn has three compartments—one for the corn, one for salt, one for butter. The dish is molded of green, chartreuse, gray, coral, or aquamarine styrene.

Rona Plastic Corp., 1525 Blondell Ave., New York 61, N. Y.

2 **Puppet apron**—Colorful vinyl children's apron which looks like Howdy Doody has movable arms with tinkling bells dangling from them. Apron, also available in Clarabell design, is part of complete line which includes garment bags, shoe bags, and hamper bags. Aprons are made of 4-gage material: the other items are 6-gage.

Citroen Industries, Inc., 225 Fifth Ave., New York 10, N. Y.

3 **Toy tomahawk**—Realistic appearance of one-piece molded styrene tomahawk will appeal to young wild Indians. Their parents will be pleased with the fact that the toy is neither sharp enough nor heavy enough to do much damage.

Moonglow Novelty Corp., 125 W. 33 St., New York, N. Y.

4 **Pocket protector**—Flexible, light-weight liner made of vinyl protects pockets from damage caused by pens or pencils. The electronically sealed liner traps any leaking ink and prevents pencil marks on the garment. Available in clear Vinylite sheeting, pique, alligator, or pigskin embossed patterns.

Angler's Products Co., 45-22 162 St., Flushing 58, N. Y.

5 **Coated chair frame**—Patio lounge chair withstands weather and wear because its aluminum tubing frame is coated with Tenite II cellulose acetate butyrate. Thus it has a lustrous, chip-proof, rust-proof surface. The low heat conductivity of the plastic surface also keeps it pleasant to the touch in even the hottest or coldest weather.

Houtz & Barwick, Box 225, Elizabeth City, N. C.

* Reg. U. S. Pat. Office.

6 **Breakfast set**—Salt shaker, pepper shaker, and condiment dish are molded of styrene in the shape of a tomato. They are molded in red, yellow, or green and have small leaves hand-painted on the top of each item. The set, including a spoon for the condiment dish, retails for 79 cents.

BW Molded Plastics, 1346 E. Walnut St., Pasadena 4, Calif.

7 **Car with transparent cylinders**—New model added to line of toys with transparent cylinder engines has distributor, spark plugs, and exhaust manifold. Like earlier versions of the toy, the Hot-See has a friction motor and a clear chassis so that the colorful crankshaft, pistons, gears, and fan are visible. All plastic parts of the 10-in. long toy are molded of cellulose acetate.

Nosco Plastics, 1617 Cascade St., Erie, Pa.

8 **Self-locking blocks**—Toy construction blocks molded of high impact styrene have interlocking dove-tail channels so that they hold together firmly. The oblong and triangular blocks which make up the set can be used to build small animals, vehicles, or buildings. Available in 37-piece Junior Set for $1.98 or the 78-piece Giant Set for $3.98 retail.

Hillcraft Co., Route 3, Traverse City, Mich.

9 **Cake cover set**—Extra-large Locking Cake Cover Set molded of styrene can be used for storing, carrying, or serving cakes or pies. Tray is 13 in. in diameter and has two handles. Clear cover, 6 in. high, has flanges which slide into slots in the tray handle so that the unit can be carried by the handle on top of the cover. The set is available for $2.98 retail.

Columbus Plastic Products, Inc., 1625 W. Mound St., Columbus, O.

10 **Soap dish**—Durable soap dish is compression molded of Plaskon alkyd material. The dish can be attached to the kitchen sink, bath tub, wash basin, or other horizontal surfaces with the two suction cups on the bottom. It is designed with a built-in tilt so that water drains off, leaving soap dry.

Colonial Mercantile & Mfg. Co. 1715 Mansfield Rd., Toledo, Ohio.


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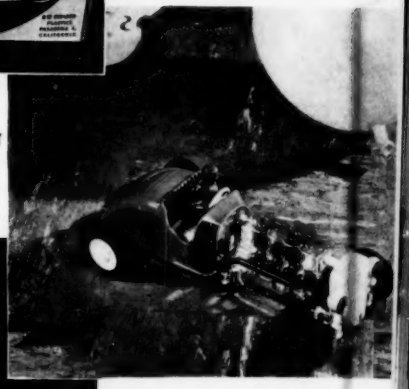
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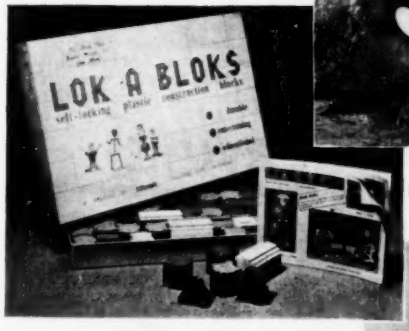

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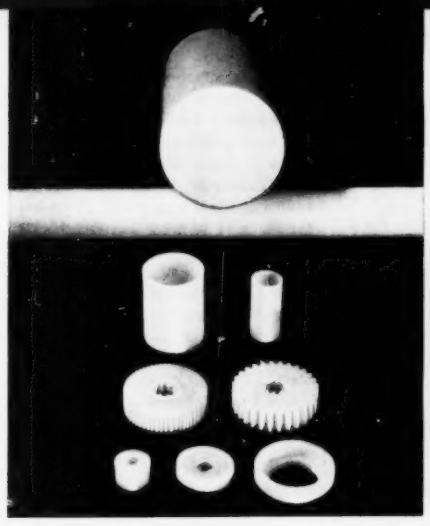
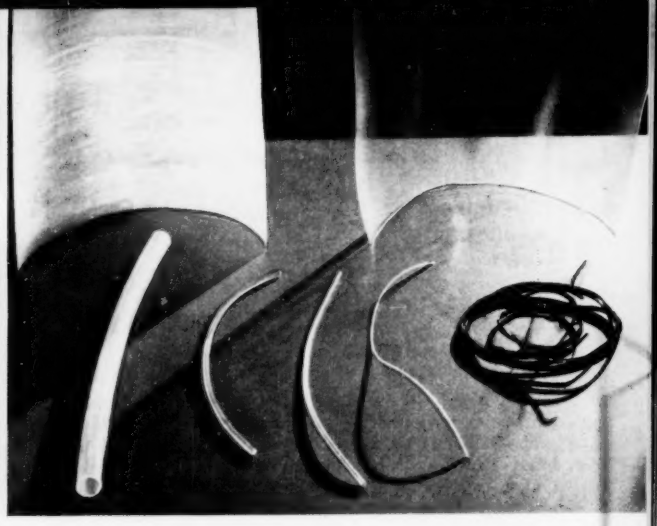
PLASTICS ENGINEERING*

F. B. Stanley, Engineering Editor



Extruded nylon rod and nylon tube stock (top) is fabricated into precision gears, bearings, and bushings (bottom)



Opaque and transparent nylon sheets and varied diameters of tubing are produced by extrusion; nylon is also used for wire covering as primary insulation

Extrusion of Nylon†

NYLON is the generic name for all materials defined as synthetic fiber-forming polymeric amides having protein-like chemical structure; derivable from coal, air, and water, or other substances; and characterized by extreme toughness and strength.

Nylon molding powders differ greatly in physical properties, and consequently each type must be treated differently in extrusion. The high-melting-point types have comparatively sharp melting points and low viscosities at melt temperature. The lower-melting-point nylons, on the other hand, are more similar to other thermoplastics in their behavior.

Components of Nylon Extruders

Fig. 1 illustrates the component parts of a typical nylon extruder. The process used is a dry, screw-type extrusion, in which granulated material is fed to the hopper, conveyed forward by the rotating screw, heated and softened by the heated cylinder, and forced through the die.

Screens and a breaker plate restrict the flow of plastic to help maintain uniform output and to filter out contamination. A head or crosshead holds the die.

The nylon screws shown in Fig. 2 have increasing root diameters from the hopper end to the head end in order to compact the granulated nylon as it melts. The last three flights have a shallow, constant depth. This section, called the metering section of the screw, helps meter the flow and keeps the material spread thin to maintain uniform melt.

Details of Components

The design of the barrel and the type of heating equipment are important for the proper extrusion of Du Pont nylon molding powders FM-3001, FM-3003, FM-3606, FM-6503, FM-6901, FM-7001, and FM-10001. These nylons require barrel temperatures as high as 650° F., and consequently oil-heated extruders have been found to be unsatisfactory. Also, comparatively long barrels are desirable, in order to introduce the great amount of heat required without having to approach the decomposition point of nylon. Practically no frictional heat is created by these nylons. If possible the barrel should be free from external flanges. The most satisfactory barrel for nylon is a one-piece barrel, which has no flanges, and which is heated by electrical band heaters as shown in Fig. 1. These heaters should be controlled by proportioning-type instruments, one to each zone. Two zones are adequate on 2-in. (bore) and smaller extruders, but larger extruders should have more zones.

The great importance of the design of the screw is demonstrated in

* Reg. U. S. Pat. Office.
† This article was specially prepared by members of the Field Service Lab., Polychemicals Dept., E. I. du Pont de Nemours & Co., Arlington, N. J.

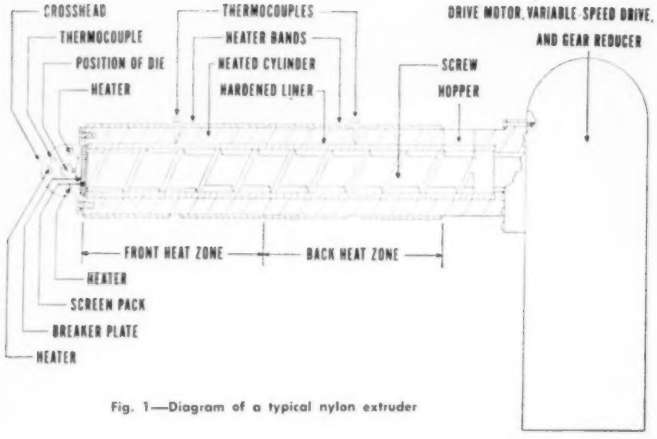


Fig. 1—Diagram of a typical nylon extruder

Table I, which shows the rates of extrusion of a nylon of high melting point (FM-3003) by screws of four different designs illustrated in Fig. 2. Similar data for a nylon of lower melting point are presented in Table II.

The information on machine capacities shown in Tables I and II was taken under the following conditions: 1) temperatures were those of back section of barrel, front section of barrel, and die; 2) diameter of orifice was 0.325 in.; 3) screen pack was one 80-mesh, six 120-mesh, and one 80-mesh for nylon molding powder FM-3003; 4) screen pack was one 80-mesh, three 100-mesh, and one 80-mesh for FM-6503; 5) the four screws used are shown in Fig. 2.

Each figure for lb. per hr. is the average of two or more 5-min. runs under the conditions shown. Under each set of conditions, additional runs of ten 10-sec. periods were taken to check short-period variation in flow. All values shown represent conditions of steady flow with the nylon free from bubbles and discoloration. Absence of data on the chart indicates that performance under the given conditions was deficient in one or more of these respects. The best results were obtained with the screw designated No. 2 in Fig. 2, and described further in Table III.

The depth of this screw is $\frac{3}{8}$ in. at the hopper end and decreases slightly in a constant taper to the metering section. There is a sudden step (section A-A in Fig. 2) at the beginning of the metering section, which consists of a section of constant depth of 0.094 inch. The screw has a constant pitch, and the compression ratio is approximately 4 to 1. The theory behind this design is that a shallow screw will allow better transfer of heat through the nylon, which has a low coefficient of heat-transfer. The metering section helps to maintain back pressure and thus a uniform flow. This section is required because nylon has a sharp melting point and because, once melted, the nylon becomes very fluid. Thus the temperature cannot be lowered at the head end of the machine to raise the viscosity of the plastic, as in usual thermoplastic extrusion practice.

Almost without exception, all jobs involving the extrusion of nylons of the higher melting points, such as those molding powders designated above, require the special screw (No. 2 in Fig. 2); the extrusion of nylons of lower melting point, which can be carried out with standard screws, is benefited as to output and quality by the use of this same special screw.

The critical dimensions of the special screw for a $3\frac{1}{4}$-in. cylinder are shown in Fig. 2. The corresponding dimensions of screws of the same design in other sizes are given in Table III. These screws have all actually been tested and found to be excellent for nylon.

In designing a screw from Fig. 2, screw No. 2, and Table III, the following additional information should be utilized:

1) There is a constant taper between depths d_2 and d_1.

2) The length of the metering section is approximate. Three flights are believed to be the absolute minimum.

3) The length of the screw depends on length of extruder barrel.

Improper screw design causes bubbles, variations in flow, and sometimes severe bridging, which interrupt the flow. The design discussed here has been proved to give much greater rates at steady flow than older designs, and fewer bub-

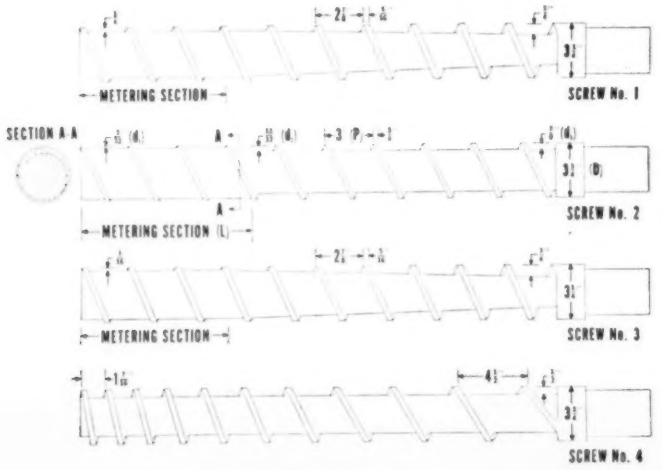


Fig. 2—Four different nylon extrusion screws

bles. For instance, the 3¼-in. screw has extruded 80 lb. per hr. of nylon molding powders FM-3003 and FM-10091, whereas the best rate with screws of former designs was 30 to 35 lb. per hour.

To aid in maintaining good back pressure, the recommended screen pack for all types of nylon is four to six 120-mesh screens, reinforced on each side with one 80-mesh screen. Equivalent packs made up of screens of different meshes are entirely satisfactory. In general, the larger the die opening, the finer the mesh of screens required. The screen pack also filters out foreign matter that may enter hopper.

Straight-head operation is generally not suitable for extrusion of nylon. A typical crosshead for nylon, shown in Fig. 3, is small, and its temperature should be accurately controlled by a proportioning-type instrument. A tubing or wire-coating die is shown in Fig. 4. The die land must be very short, usually 1/16 to 1/8 inch. Fig. 5 shows a typical die for extruding a nylon shape. This type of crosshead and die is not required for extrusion of FM-6503, which can be extruded from more conventional thermoplastic equipment.

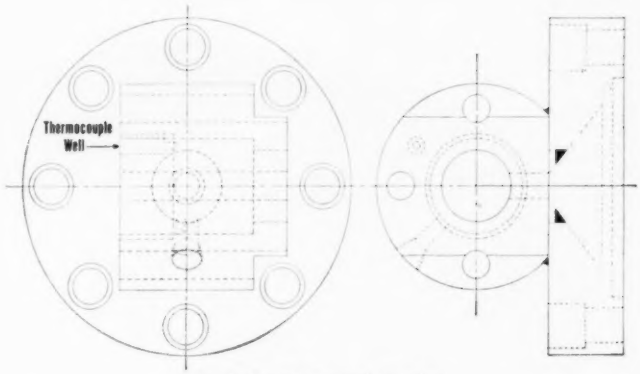


Fig. 3—Typical crosshead for nylon

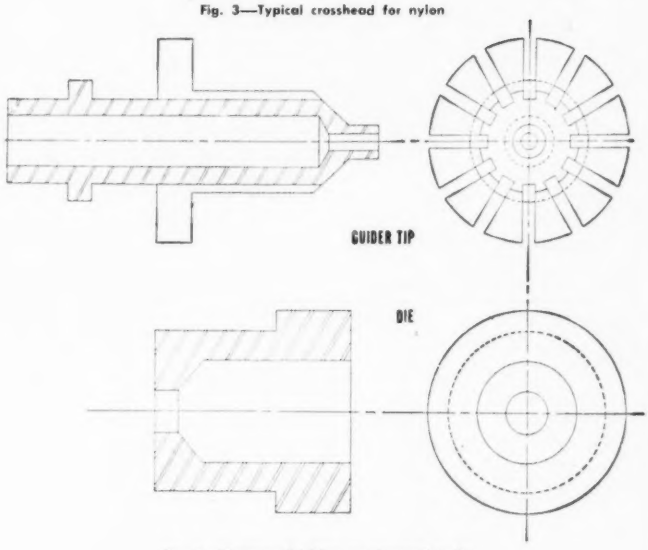


Fig. 4—Diagram of tubing or wire-coating die

Moisture in Molding Powder

Since all nylon molding powders pick up moisture, it is recommended that they be dried prior to extrusion. For this purpose, tray driers are satisfactory. The drying temperature should be 175° F. for a period of three to six hr. for most extrusions. Higher temperatures should be avoided to prevent discoloration and embrittlement of the nylon. A forced circulating hot air atmospheric pressure oven generally used for other plastics will suffice. The material should be loaded in the trays to a depth not greater than one inch. After drying, the powder should be fed directly into the extruder.

Scrap may be reused, provided it is kept clean. It should be ground and redried before being fed back into the machine. Water-quenched material will require a long time for drying. For material which has been quenched for three min., 16 hr. at 175° F. has been found adequate, and

Table I.—Lb. per hr. of FM-3003 Nylon from Electrically-Heated 3¼-in. Extruder.

Screw	*Screw*	*Average barrel and die temperature*				
R.P.M.	*No.*	*450° F.*	*475° F.*	*500° F.*	*525° F.*	*550° F.*
4½	1	8.9	10.6	11.5	13.6	—
	2	12.5	14.6	16.9	—	—
	3	7.5	—	—	—	—
	4	—	16.1	—	—	—
8	1	15.2	—	—	—	—
10	1	—	18.0	17.2	23.0	—
11	1	—	—	28.1	—	—
	2	23.9	22.8	27.1	—	—
	3	24.4	—	—	—	—
	4	25.2	—	—	—	—
16	2	28.5	32.1	35.5	—	—
	3	28.3	—	—	—	—
	4	24.6	—	—	—	—
22	2	35.8	41.6	44.8	44.5	—
	3	30.8	—	—	—	—
30	2	—	53.9	54.3	57.2	59.1
36	2	—	62.3	62.8	68.4	66.8
42	2	—	—	—	80.4	79.8
46	2	—	—	—	—	83.4

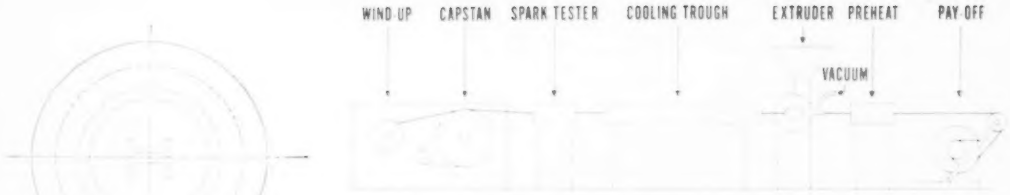


Fig. 6—Set-up of extruder for wire-coating operation

Fig. 5—Typical die for extruding nylon shapes

drying under these conditions does not discolor the nylon objectionably.

Obviously, care must be taken to avoid accidental admixture of scrap of one type of nylon with scrap or new material of another type.

Methods of Extrusion

Coating of wire and cable—Du Pont nylon molding powders FM-3003, FM-3606, and FM-7001 are used for coating wire. As a primary insulation on small wire, nylon can be applied at very high speeds and in very thin coatings. A rate of over 1600 ft. per min. has been achieved with suitable take-off equipment. A thickness as low as one-half a mil is possible. When nylon is applied as a primary insulation, good adhesion between nylon and wire can be obtained by pre-heating the wire by resistance or radiant heating. Smaller wires can be coated while passing vertically downward into a quench bath. The water level should be raised to within an eighth of an in. or so of the die. For larger wire, or where existing equipment dictates, horizontal operation is best. The usual method is shown in Fig. 6. The cascade of water should be brought as close as possible to the die.

Fig. 7 illustrates the crosshead and die assembly for coating wire with nylon. Vacuum is applied between the wire and guider tip in order to pull the flowing cone of plastic close to the die. By so doing, a smoother coating is achieved, and adhesion improved. Dies similar to the one shown in Fig. 4 are used. The annular space between the guider tip and the die at the point where the molten nylon is extruded upon the wire should have a thickness between five and ten times the desired thickness of the coating on the wire. The wire passes through the head faster than the molten nylon is fed upon it, and thereby the thickness of the layer of nylon is reduced as it is being deposited on the wire. Thus the thickness of the coating is controlled by correlating the speed of the extruder and the take-up speed of the wire. Between the quench bath and take-up, the wire is generally spark-tested for breaks in the insulation.

The same methods are used for extruding a nylon jacket over a primary insulation, instead of directly on the metal.

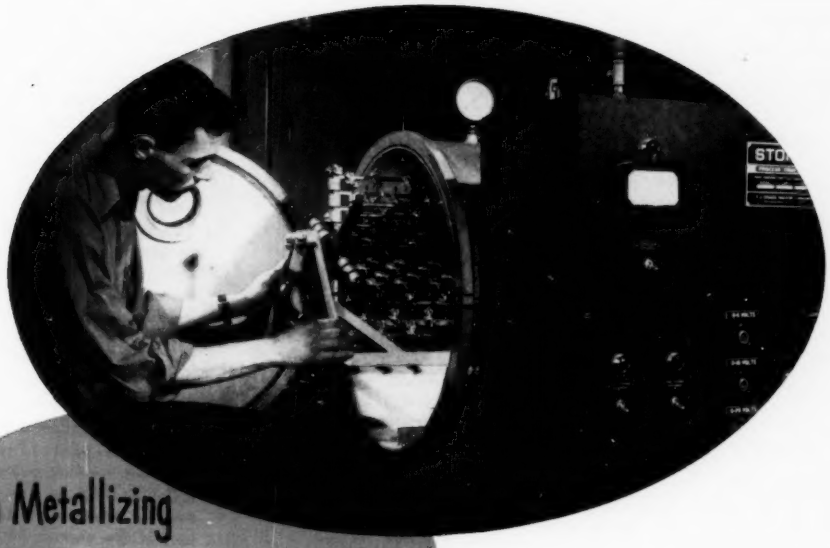
Nylon molding powder FM-6503 and FM-6901 have been used extensively for coating cable. These nylons require a long quench bath and sufficient time between extrusion and take-up so that their surface will cease to be tacky. The time required for the surface to set de-

Table II—Lb. per hr. of FM-6503 Nylon from Electrically-Heated 3¼-in. Extruder.

Screw R.P.M.	*Screw No.*	*Average barrel and die temperature* 400° F.	425° F.	450° F.	475° F.	500° F.
4½	2	9.6	11.0	12.2	12.5	12.7
	3	—	21.6	20.1	24.0	23.4
	4	17.3	18.6	20.3	19.3	22.2
11	2	28.3	28.7	30.0	30.5	31.4
	3	—	38.0	38.3	41.1	37.9
	4	38.2	36.3	40.6	41.1	43.2
16	2	40.1	41.7	42.7	42.2	44.7
	3	—	—	—	58.3	53.6
	4	50.7	52.3	52.0	59.5	66.3
22	2	56.4	57.1	57.7	58.8	60.5
	3	—	—	—	78.2	70.2
	4	—	70.0	68.8	72.5	76.2
28	2	72.4	72.0	71.8	73.6	75.2
	3	—	—	—	—	84.8
36	2	84.0	88.5	87.8	88.3	92.4
	3	—	—	—	—	99.7
42	2	78.2	107.5	106.0	109.0	110.4
	3	—	—	—	—	114.0

Table III—Critical Dimensions of Special Extrusion Screw for Nylon (No. 2 in Fig. 2).

Diameter (D), *in.*	*Pitch* (P), *in.*	*Length of metering section* (L), *no. flights*	*Depth of metering section* (d_1), *in.*	*Depth before metering section* (d_2), *in.*	*Depth at hopper end* (d_3), *in.*
1¼	1	5	3/32	3/16	5/16
1½	1½	5	3/32	3/16	5/16
2	2	3¼	3/32	3/16	7/16
2½	2½	3	3/32	3/8	3/8
3¼	3	3	3/32	11/32	3/8
3½	3½	3	3/32	11/32	3/8
4½	4½	3	3/32	11/32	3/8
6	6	3	3/32	11/32	3/8
8	8	3	3/32	11/32	3/8
10	10	3	3/32	11/32	3/8



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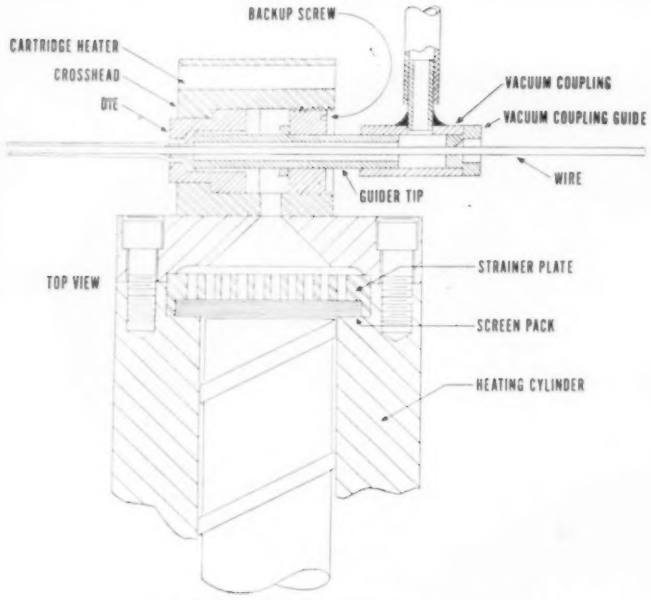
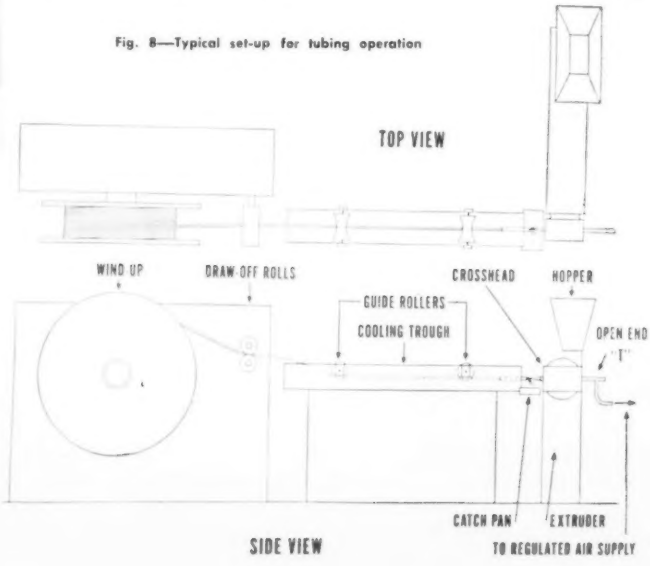


Fig. 7—Crosshead and die assembly for coating wire with nylon

pends on the thickness of the coating and the temperature of extrusion. About $1\frac{1}{2}$ min. is usually required.

Tubing—Tubing of nylon powders FM-3001 and FM-10001 is produced by the method shown in Fig. 8. Extrusion vertically downward into a water-bath has been successful only when the arrangement is such that water inside the tube is maintained at about the same level as the water outside the tube. Application of air to keep the tube from collapsing causes blowouts between the die and the waterbath because of the fluidity of the nylon. The method shown provides horizontal extrusion into a quench bath by leading the tubing into the bath through a horizontal pipe set below the water level. The pipe should have an inside diameter no greater than twice the outside diameter of the nylon tube being produced. Larger pipe will allow too much water through the pipe and make the nylon very difficult to start. Air under regulated pressure introduced into the tubing through an open end "T" makes possible the production of a limited variety of sizes and wall thicknesses with a single die. Tubing die is the same as the wire-coating die shown in Fig. 4. Diameter and wall thickness are determined by size of die, temperature, speeds of screw and take-up, and amount of air introduced. Tubing of FM-6504 can be produced by the same method, or by more conventional thermoplastic techniques.

Fig. 8—Typical set-up for tubing operation



Shapes—Vertically downward extrusion is used to make shapes of nylon molding powders FM-3001 and FM-10001. In this case it is especially important to bring the surface of the quench bath as close to the die as possible, in order to freeze the shape before the fluidity of the nylon permits it to be distorted. Usually the temperature of the die is kept at about 60° F. above the melting point of the nylon until the nylon has started to flow through it. Then the temperature of the die is lowered to a point approximately 10° F. above the melting point of the nylon being extruded. A closer approach to the melting point may be made, so long as this does not freeze off the flow.

Die design depends on the shape of the extruded item, but a draw-down of 1.5 to 1 is average. (See Fig. 5 for a typical die.) Usually the die will have to be tried and modified several times before the exact desired shape is obtained. The die opening must not be too large, because the material delivered is very fluid. Quenching is sometimes done in a bath of hot oil, in order to avoid very rapid cooling, which may cause formation of shrinkage voids in the nylon. Nylon molding powder FM-6503, although suited to this type of operation, can be extruded into shapes by more usual methods also.

Sheeting—All commercial types of nylon molding powder can be extruded as sheeting by using the die developed by the Du Pont Co. for this purpose (Fig. 9). This die consists of a polished manifold, slotted along its length, and equipped to re-

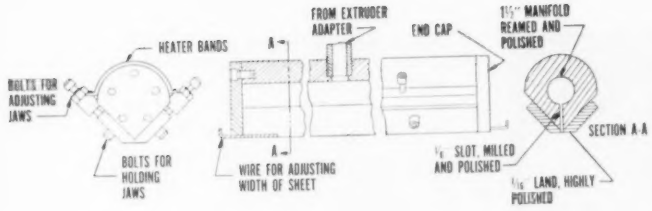


Fig. 9—Die for extruding nylon as sheeting

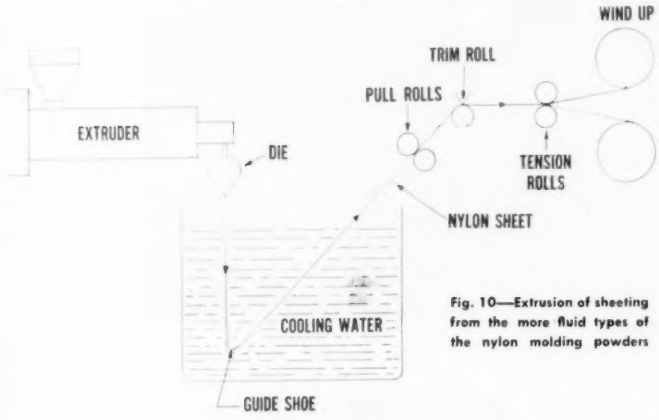


Fig. 10—Extrusion of sheeting from the more fluid types of the nylon molding powders

ceive the molten resin through either one of its ends or through an orifice located midway along its length. The manifold should be of one-piece construction with a bore that has been precision-drilled, reamed, and given a high polish. The slot should be carefully milled and polished, since any surface irregularities will cause caliper variations. A short section of ⅛-in. drill rod is inserted at each end of the die in such a manner that it can be extended or withdrawn to adjust the width of the extruded sheet. Die jaws are mounted on the face of the manifold and can be adjusted to give any desired die opening. They are set to give a film having constant caliper throughout its width. The die jaws have lands about $^{1}/_{16}$-in. long, which must be carefully maintained and kept well-polished if a good, constant-caliper coating is to be produced.

In the extrusion of nylon sheeting, the operation should be started at the maximum temperatures given in Table IV for the various nylon molding powders. When the sheet emerges from the die, the temperatures should be reduced to the lower temperatures shown in Table I for continuous operation.

The method of handling the sheeting varies with the type of nylon, because of variations in fluidity, strength of the molten sheet, and crystallization characteristics. The extrusion of the more fluid types, such as nylon molding powders FM-3001 and FM-10001, and modifications thereof, is illustrated in Fig. 10. These types are extruded into a water quench bath. The bath must be so arranged that the water level is maintained within ¼-in. of the die. Since the water in the bath is so close to the die, it is necessary that the bath be reinforced, to eliminate any surface ripples.

The flexibility and transparency of nylon sheeting are affected by chilling rate. Quenching in cold water tends to make the sheet more transparent and flexible, while hot water makes it more opaque and stiff. Because of the sensitivity to quench water temperature, good circulation is necessary to prevent localized areas of hot water, which will cause streaks and spots on the sheet. At the same time, however, this circulation must not cause impingement of streams of water on the uncooled nylon. The nylon sheet is sufficiently fluid at this stage so that any strong movement of water will cause surface wrinkles to form.

The nylon is pulled by a pair of driven rubber rolls. The rate at which these rolls are turning with respect to the rate at which the sheet is extruded will control the caliper.

An edge-slitter is installed after the pull rolls. This may be a razor-blade type, but a shear-type trimmer is preferred. Trimming of the edge is necessary to remove the slightly heavier section at the edges. This permits a smooth wind-up. Winding may be accomplished on either axial- or surface-type wind-up rolls.

The more viscous and slower set-

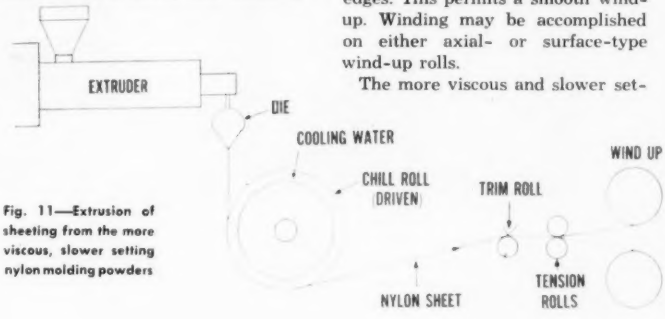


Fig. 11—Extrusion of sheeting from the more viscous, slower setting nylon molding powders

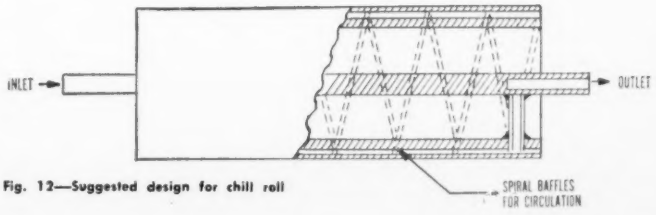
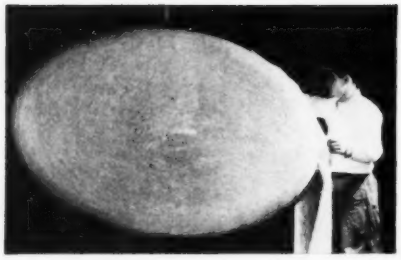


Fig. 12—Suggested design for chill roll

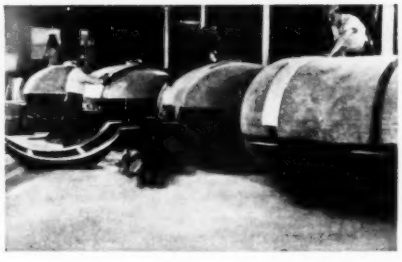


One inexpensive wooden mold is used to produce both halves of the Aramco fuel tanks, keeping tool costs at a minimum. The outer surface of the wood is sprayed with wax, which serves as parting agent, then polished.

LAMINAC Resin is sprayed on the mold in a inch coat. Layers of Fiberglas mat are added and specially catalyzed resin is sprayed over each layer. Before final cure, the two halves are assembled and reinforced with LAMINAC-impregnated Fiberglas tape.

Steel tanks? No...PLASTIC because

Bronze fittings are securely anchored in place with additional LAMINAC reinforced plastic. A big advantage of LAMINAC is that such additions—and any needed repairs—become an integral part of the original assembly.



Steel bolsters and bands are attached and the whole unit is covered with LAMINAC-Fiberglas combination to make it one solid, corrosion-proof piece. The walkways along the truck sides, the housing for the pumping mechanism and the 100-gallon water tank behind the cab are also made of LAMINAC.

they outlast steel **10** to **50** times!

Battered by sandstorms, baked by desert sun, attacked by desert night dampness . . . steel fuel tanks on Arabian-American Oil Company trucks wore out fast. Replacement costs were terrific.

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. . . LAMINAC's light weight permitted two 1000-gallon tanks weighing 1000 pounds each to replace one 2300-pound steel tank holding only 1500 gallons.
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We may be able to help you meet military specifications where plastics and resins are concerned. What's your problem?

Table IV—Nylon Molding Powders.

Code	Extrusion temperatures	Remarks
FM-3001	450-550° F	more flexible, more water-resistant than FM-10001
FM-3003	450-550° F	heat-stabilized FM-3001, used for wire-coating
FM-3606	475-525° F	used for wire-coating
FM-6503	375-425° F	extrusion grade of flexible type
FM-7001	475-550° F	used for wire-coating
FM-10001	550-625° F	stiff; high temperature-resistance

ting nylon molding powders, such as FM-6503 and FM-6901 and modifications thereof, are extruded as illustrated in Fig. 11.

The chill roll should be as close to the die as possible. A suggested design for this is shown in Fig. 12. The relationship of the speed of the driven chill roll to that of the extruder determines the caliper. This film must also be trimmed. Shear-type cutters are the most satisfactory for this. Either surface- or axial-type wind-up rolls may be used.

Symptoms and Causes of Troubles

Bubbles—The appearance of bubbles in nylon as it extrudes from the die may be caused by several factors: 1) The nylon may be wet and should be redried. 2) The screw may be of improper design. 3) The nylon may be overheated in which case it will also be discolored. 4) Air may be entrapped in the nylon, which can be eliminated by reducing the screw speed and increasing the fineness of the screens. 5) The die opening may be too large, or the output capacity of the machine is being exceeded. 6) In coating operations, the material being coated may be wet.

Variation in flow—Variation in flow or surging may be the result of a number of factors: 1) Improper screw design; 2) excessive screw speed; 3) improper crosshead; 4) a cold spot in the barrel as the result of a burned out heater band; or 5) incorrect temperature settings.

Cleaning Nylon from Extruder

Two ways are recommended to clean nylon from the screw, breaker plate, crosshead, and dies. The choice depends on the extrusion operation. In a plant where long production runs are normal practice, parts are frequently cleaned by blow torch and wire brush but a molten salt bath is usually preferred.

Cleaning the barrel—The screw is pushed out while the barrel is still hot. With heat still on the barrel, a boiler-tube brush wrapped with copper mesh is pushed in and out of the barrel several times. More copper mesh is then added, and the brush is used again. This procedure is repeated until the barrel is clean. A light held over the hopper will generally allow good visual inspection of the barrel. The boiler-tube brush should have actually the same diameter as the inside of the barrel, so as to fit it closely. The face of the barrel can be cleaned by a wire brush while the machine is still hot.

Salt bath—The salt bath (Fig. 13) is heated to around 750° F. A basket is loaded with extruder parts to be burned off, and lowered into the salt bath. The nylon on the various parts will burn as soon as the temperature of the parts rises sufficiently. If the bath is hot enough, combustion will take place within a few seconds.

When the bath stops flaming, in about 5 to 10 min., the parts are free of nylon and carbon. The basket is then removed from the salt bath and lowered into a circulating water cooling bath. After the basket and parts have become cool enough to handle, a blast from an air hose is used for drying.

Heat transfer salts such as "Hi-tec" (manufactured by the Explosives Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) can be used. This salt melts at 288° F., but must be above 660° F. to burn off nylon and remove carbon.

The following safety measures should be observed in using the salt bath: 1) Keep temperature of bath below 1000° F.; 2) keep an ample

(*Continued on p. 172*)

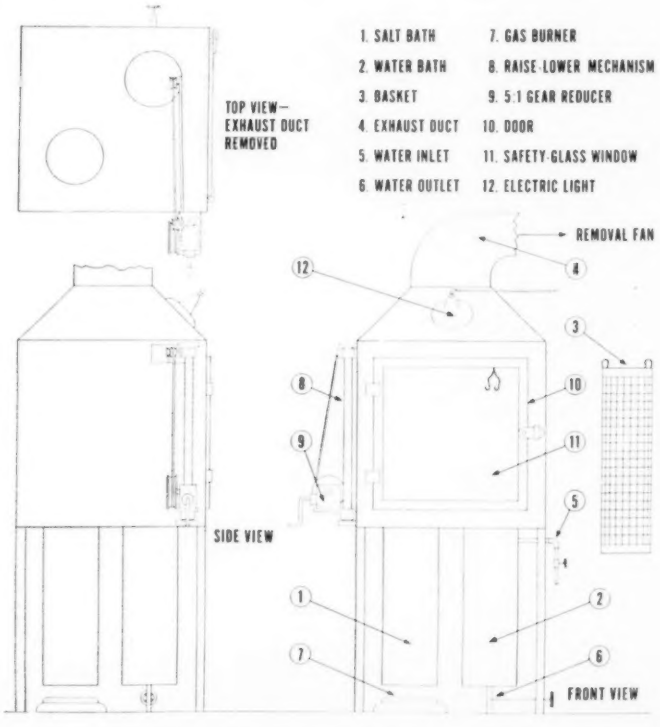

Fig. 13—Molten salt bath for cleaning nylon from extruder parts

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Vinyl Plasticizer Developments

by RICHARD G. KADESCH†

Trends that will continue and some new ones that will develop in the marketing and utilization of plasticizers in vinyl plastics:

Increased demand for non-toxic plasticizers in food packaging, etc.

More requirements, particularly by the military, involving flame resistance and low temtemperature-flexibility together.

Greater importance of rigid and semi-rigid uses.

Plastisols will become even more popular.

Plasticizer and finished product standards will rise further.

The single all-purpose plasticizer will be used even less. Rather, blends for specialized use in which each component contributes something.

More extensive use of permanent, non-migrating plasticizers of lower viscosity.

Alcohols and acids suitable for plasticizer manufacture will be available in greater variety.

More competition for esters from non-plasticizer uses such as smokeless powder (dibutyl phthalate, etc.) and oils and greases (diesters).

THE production of vinyl chloride polymers and copolymers has been expanding rapidly. Output during 1946, 1950, and 1951 was 98, 276, and 350-400 million lb., respectively. About half this amount of vinyl plasticizers is required. In 1950, 149 million lb. were used (7)[1]. During 1951 the raw material situation for plasticizers was somewhat beclouded. For example, the phthalates are important in all vinyl applications of film, sheeting, molding, extrusion, and coating. They depend on phthalic anhydride which depends on naphthalene. Other outlets compete for both these intermediates. Supplies improved during 1951 with help from imported naphthalene and phthalic anhydride from *o*-xylene. Temporary situations like this constantly threaten the supply of a desired plasticizer, often requiring formulation revision. When making changes, a thorough understanding of plasticizer functions and properties is needed. Such understanding has also enabled greater use of special plasticizer types and blends to meet specific applications and more stringent requirements. The present discussion principally emphasizes developments during the last five years.

Mechanism of Plasticizer Action

Polyvinyl chloride type polymers possess considerable crystalline character and do not become flexible without plasticizer until heated to about 100° C. The heating weakens the dipole interactions or secondary valence forces between polymer chains sufficiently to permit deformation. A plasticizer permits deformation at much lower temperatures by replacing many of these polymer-polymer attachments with plasticizer-polymer ones. When the new attachments are strong we have true solvent action and such plasticizers are "solvent type" (21). If the plasticizer-polymer interaction is practically nil, the plasticizer is a "non-solvent type," is merely a spacer, and cannot be used alone. A third intermediate type has limited compatibility with the resin. The role of solvent power has been studied by dilution ratio determinations (31). The idea that plasticizer compatibility results from plasticizer-polymer interaction stronger than the polymer-polymer one is questionable. The positive entropy of mixing is important (44,99). A plasticizer must aid micro-Brownian motion of chain segments, permitting long-range elasticity to develop, but must permit a three-dimensional gel structure enabling elastic recovery. Such a gel structure is indicated by X-ray studies (4) and other physical means (5). The crystalline regions are now present in relatively small amount and are regarded as the cross links. Creep (slow continuous relaxation under stress) is regarded (5) as resulting from the elongation of amorphous regions between crystallites until equilibrium is reached. The weakest spots in the crystallites break, a new configuration results, and the process is repeated. The associations between chains are believed to have a wide range of stabilities (77). Present theories do not appear to explain creep behavior under large strains (33). The above picture can be considered in either of two extreme ways (2): Dynamic solvation-desolvation between polymer and plasticizer which is rapid relative to the rate of elastic response; or relatively fixed attachment of plasticizer to resin. Plasticizer size and shape are considered important in plasticizing efficiency (44,45,99) and electrical properties (66). This determines the surface

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* Reg. U. S. Pat. Office.
† Research Director, Emery Industries, Inc.
[1] Numbers in parentheses refer to references beginning on p. 182.

which the plasticizer presents to the polymer (99). Electron microscope studies (11) show that the plasticizer causes spherical Saran latex particles to flatten, coalesce, and finally merge.

Effect of Polymer Structure

Change in polymer structure resulting in lower deformation temperature is often called "internal plasticization" (89). Thus, unplasticized polyvinyl acetate becomes flexible at only 40° C. This principle is used in the commercial vinyl chloride-vinyl acetate copolymers. However, it was not possible to duplicate plasticizer-polymer compositions with an internally plasticized polymer (4). When sufficient comonomer was present for flexibility, the gel structure was lost. A commercial vinyl polymer employs the co-monomer principle to enable processing without plasticizer but many desirable properties are sacrificed (51). This is perhaps the vinyl chloride-alkyl acrylate-vinylidene chloride copolymer recently patented (92). The higher the bonding forces of the polymer the more polar the plasticizer must be (27). Given tensile properties are obtained at lower plasticizer contents with polyvinyl chloride-acetate than with polyvinyl chloride but the brittle temperature depends more on the plasticizer than on the polymer (83). In vinyl chloride-vinylidene chloride copolymers the plasticizer efficiency and compatibility generally increase as vinyl chloride content increases (53).

Properties

Various physical properties have been tabulated for compositions containing practically all the commercially available plasticizers and many experimental ones (78,79,80).

Compatibility—Adequate compatibility depends on the proper kind and arrangement of polar groupings. Ester groups are among the most effective. With dibasic acid esters of mono- or polyhydric alcohols, or monobasic acid esters of polyhydric alcohols, the compatibility limit is about 26 carbon atoms total (37). With phthalates, adipates, and thiodibutyrates, compatibility is lost when the alcohol reaches C_9-C_{11}.

Volatility — Determinations of plasticizer volatility by the usual accelerated tests often lose value because effects of migration, air direction and velocity, neighboring samples, and humidity interfere. Many of these difficulties are overcome by elaborate equipment (64, 84). A simple means of eliminating most of these effects involves heating the sample in contact with activated carbon in a closed jar (94).

If temperature is below 100° C., air velocity below one cm. per sec., and plasticizer content below 17%, the rate of plasticizer evaporation controls the weight loss (90). Losses from compositions in vacuum at 110-155° C. are about the same for tricresyl phosphate, dibutyl phthalate, and dibenzyl sebacate (63). Under these extreme conditions diffusion rate within the plastic is the determining factor.

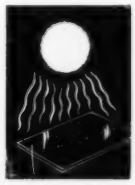
Migration and Sweat-Out—Migration is usually determined by observing the marring of a cellulose nitrate or other appropriate coating after contact with the vinyl composition. This method has several shortcomings as do other recently suggested methods such as determination of the hardness of the cellulose nitrate or weight loss of the vinyl after contact.

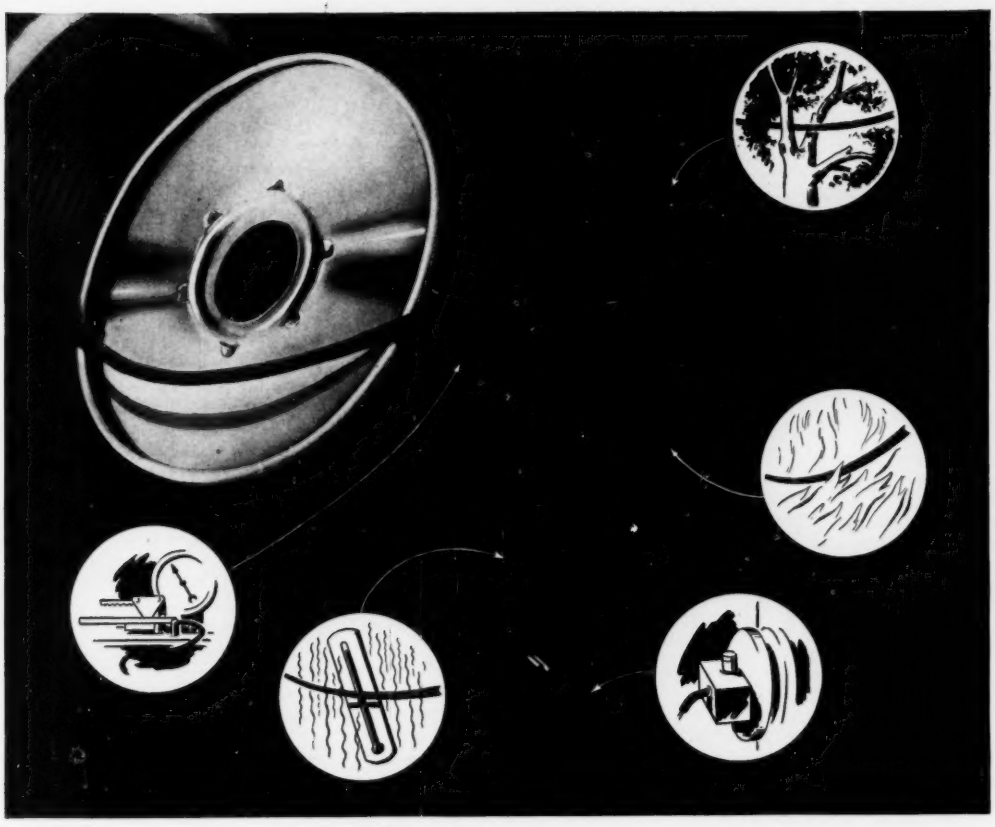
A recently proposed method is based on the weight loss of the sample after heating at low temperature with silica powder in a closed jar (47). This method shows appreciable migration with polyester type plasticizers which show very little or no migration by usual methods. Another promising method involves labelling plasticizer with carbon 14 and following with a Geiger counter rate of migration into cellulose nitrate.

The diffusion rate within the plastic decreases rapidly as plasticizer concentration decreases (63). This agrees with the practical experience that sometimes a small increase in plasticizer content causes a large increase in migration (80). There is a correlation between attack on coatings and oil extractability of the plasticizer (80). Monomeric aliphatic esters are poorest with respect to migration, dibutyl sebacate and alkyl phosphates being particularly bad. Aromatics such as tricresyl phosphate and the phthalates are generally very good and the polyesters even better. Ether linkages hurt migration. With sebacates and phthalates of *n*-alcohols, migration decreases as the alcohol chain length increases (62). A small amount of basic lead silicate, ethyl cellulose, or silica gel inhibits spew of vegetable oil type plasticizers (74). A specific result of migration is "sweat-out." Three methods of observing it currently considered of value (95) involve picking up exuded plasticizer on a cigarette paper or ground glass plate, or measuring weight increase after tumbling with silica.

Extraction—Measurements of extraction of plasticizer by water or organic solvents are generally complicated by absorption of some solvent by the plastic in addition to extraction. Solubility of the plasticizer alone in the extractant does not necessarily correlate with the amount extracted from a composition. Ether linkages increase water sensitivity (62). Oil and kerosene extraction are improved by aromatic groups and even more by some polyesters. Paraplex G-60 shows unusually good resistance to extraction by soapy water. The use of a plasticizer labelled with carbon 14 and a Geiger counter has also been applied to extraction measurements.

Heat and Light Stability—The breakdown of plasticized polyvinyl chloride type resins during heat or light exposure results in embrittlement, discoloration, or plasticizer exudation. Generally, polymer breakdown is involved. Formation of conjugated unsaturation plays a role in color formation but apparently the loss of hydrogen chloride is much too small to account for it entirely (105). Various other types of degradation have been postulated (10,61). With dibutyl tin dilaurate as stabilizer, the heat stabilities of eight different plasticizer





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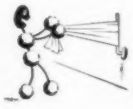
types have been rated (54). Unsaturated ether esters and alkyl esters are best. Polyesters, aryl esters, unsaturated esters, and ether esters are intermediate. Phosphates and chlorine compounds are poor. Aliphatic esters have the greatest flexibility regarding the choice of stabilizer. Chlorinated compounds can be satisfactorily stabilized by dibasic lead phosphite (54,55). A classification of plasticizers according to their degradation products has been found useful in considering stability problems (40).

Flexibility—Minimum change of stiffness with temperature is generally desired. Measures of flexibility besides stiffness or ease of bending (25) are plasticity (30), cold crack temperature, ease of stretching (100% modulus), and second order transition point. The latter is being used more and more to indicate low temperature behavior. It can be determined by the change in slope of a curve relating volume or refractive index with temperature. Creep studies, showing variations with time of tension under stress, have also been valuable since the immediate stiffness does not completely depict flexibility (2). Low temperature flexibility of a composition correlates with plasticizer viscosity (28,37)[2], with temperature dependence of solvent strength of the plasticizer (31), or with oil extractability of the plasticizer. The latter parallel probably arises from the dependence of both on the rate of diffusion of the plasticizer within the resin (2). Temperature effects diminish at lower plasticizer contents (59). Polymeric plasticizers are an exception and a lot can be used without undue increase of temperature dependence.



Plasticizer creep curves (flexibility vs. time) may be divided into four classes (2). The steeper the curve the greater the rate of creep. The higher the curve the greater the efficiency. Class 1 has steep, high curves such as tetrahydrofurfuryl sebacate. Class 2 has steep, low curves such as tricresyl phosphate, dibenzyl sebacate, and the Aroclors. Both 1 and 2 show great rigidity in quick tests but much creep in long time tests. Ring structures lead to the undesirable steep curves of 1 and 2. Class 3 has flat, high curves such as trioctyl phosphate, tetraglycol dipelargonate, dibutyl sebacate,[3] and diamyl azelate. Class 4 has flat, low curves such as nonaglycol diperlargonate, Paraplex G-25, PD-16, P-6, triglycol dioctanoate-decanoate, and Dutrex 20. Linear alkyl chains lead to the flat curves of 3 and 4. Class 4 generally has limited compatibility. Dioctyl phthalate is intermediate between 2 and 3; dioctyl sebacate and diethylene glycol dipelargonate between 3 and 4.

Flammability—As thinner films have been sold, flame resistance has become more important. Although polyvinyl chloride itself does not support combustion, most compositions contain enough plasticizer to render the whole flammable. Polyester plasticizers materially reduce the burning rate. Sufficient amounts of chlorinated plasticizers or phosphates render thin films self-extinguishing. The phosphates are the more effective with aryl phosphates being superior to alkyl phosphates. Chlorophthalates have been unsuccessful because of poor efficiency and flame retardent properties. Recently a flammability testing method was recommended involving automatic timing and sample ignition (96).

Toxicity—Polyvinyl chloride itself is considered harmless when used in contact with foods. But most plasticizers have not been tested sufficiently to guarantee their edibility. Tricresyl phosphate has been condemned to various degrees depending on the purity and the isomers present. Less than two years ago only one plasticizer had met FDA requirements for food use. Even now it appears that only ethyl phthalyl ethyl glycolate, butyl phthalyl butyl glycolate, and octyl diphenyl phosphate have fulfilled the two-year chronic feeding tests required by the FDA (68). It is claimed that di(2-ethylhexyl) phthalate is equally acceptable and it has received approval.

Mold and Fungus Resistance—Polyvinyl chloride is resistant to micro-organism attack so that susceptibility to bacteria, fungus, or mildew is determined by the plasticizer present. The Quartermaster Corps tested 83 plasticizers against Aspergillus niger and found none fungicidal (1). No support of growth in a sugar-free medium was provided by twelve different phthalates[4], the citrates, tricresyl phosphate[5], tributyl phosphate, triglycol di(2-ethylhexoate), and triglycol di-(2-ethylbutyrate). Sebacates, stearates, and methyl Cellosolve oleate support moderate growth. The ricinoleates and Paraplex G-25 are the poorest. Very little correlation of growth with plasticizer structure is possible. Many inhibitors for microbiological deterioration are known and a few, such as copper 8-quinolinol, are claimed to be effective in vinyls. Plasticizers and inhibitors used must be harmless on skin, resistant to weathering and extraction.

Electrical Properties—Plasticized polyvinyl chloride compositions have excellent electrical properties if the right plasticizer of good purity is used. Purity standards have generally improved so that the standard grade of several plasticizers is equivalent to the electrical grade. The size and shape of the plasticizer is important. As plasticizer content increases the dielectric constant and loss factor go through a maximum (66). The temperature maximum of the electrical dissipation factor correlates better with brittle point than does plasticizer viscosity (103). Several of the aromatic plasticizers such as dioctyl phthalate and tricresyl phosphate have good electrical properties. Aliphatic plasticizers with good electrical properties and low temperature flexibility seem to be less common. Glycol esters improve when going up the glycol series or when the acid portion is branched (37). Sulfur often helps as in dibutyl thiodiglycolate and methylene bis(butyl thioglycolate) which were used in insulation in Germany (28). Maleates are good, with di-*n*-decyl dichloromaleate the best in Germany for the cable industry (37).

Miscellaneous Properties — The various alkyl phthalates have about the same efficiency. Tricresyl phosphate and cyclohexyl phthalate are less efficient while the adipates and butyl Cellosolve phosphate are more efficient (72). The Lupke resilience

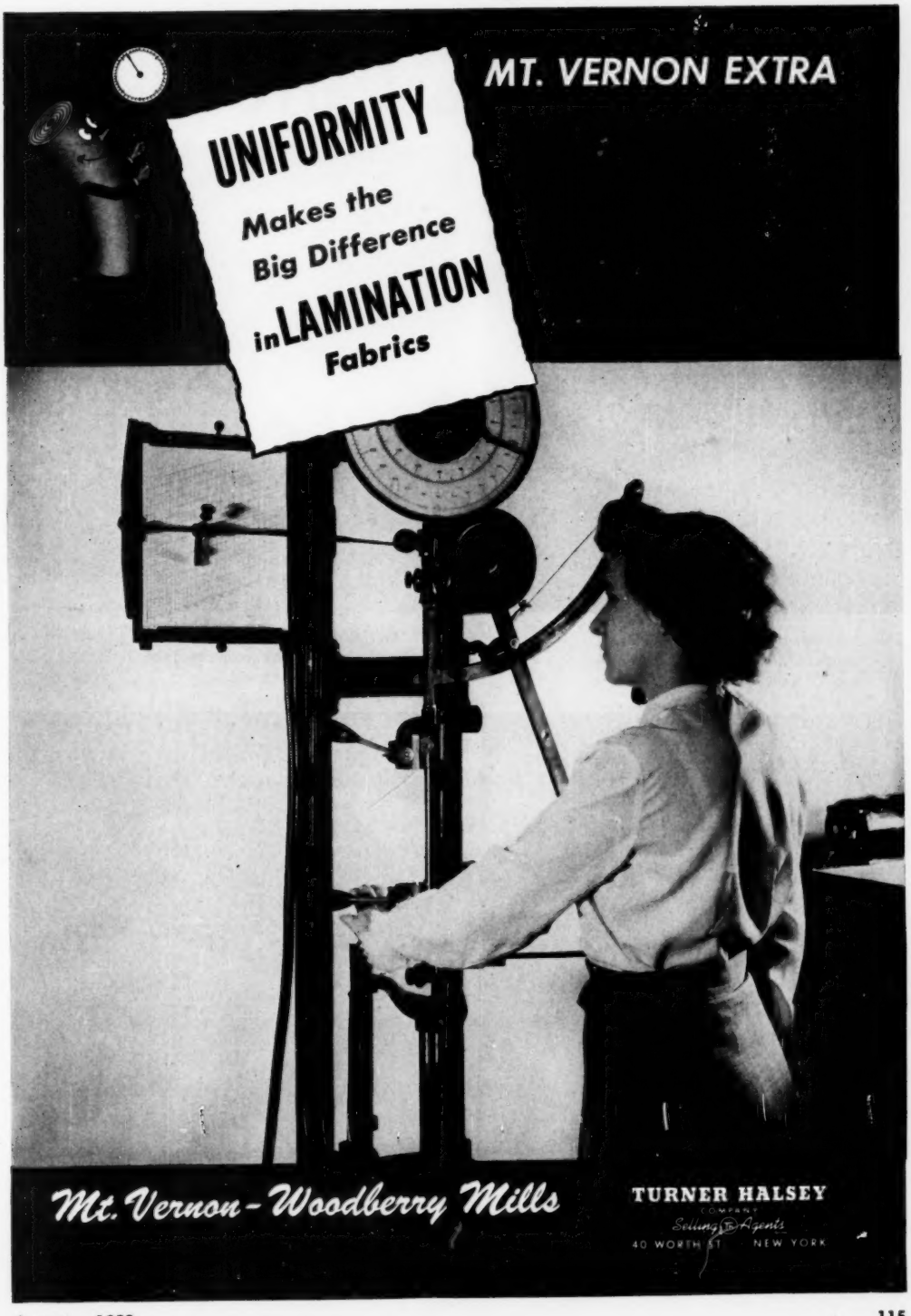
(*Continued on* p. 118)

[2] An exception is triphenyl phosphate which functions about like tricresyl phosphate even though a solid.

[3] Based on plasticizing action alone this is the most effective of all tested, but is often too volatile.

[4] Dicapryl phthalate and ethyl phthalyl ethyl glycolate support growth slightly.

[5] However, triphenyl phosphate supports growth slightly.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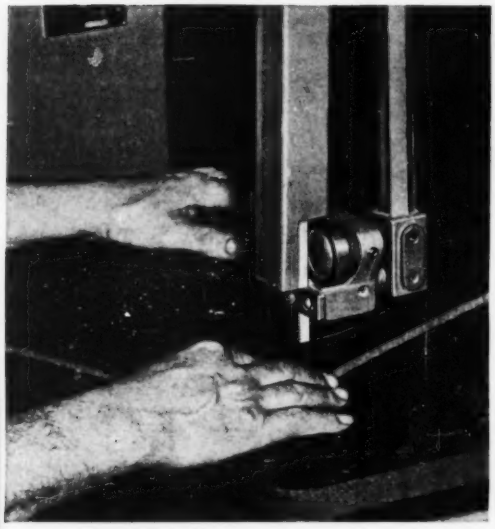
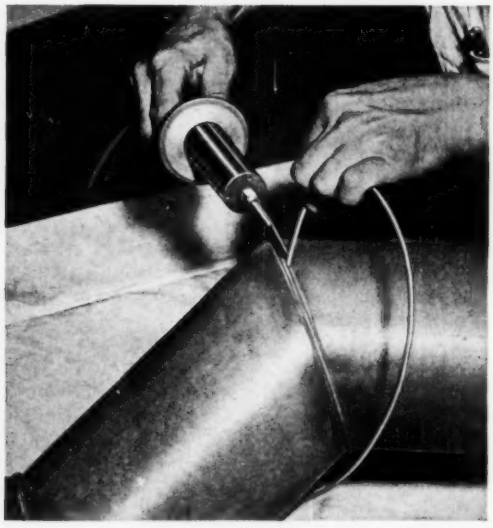
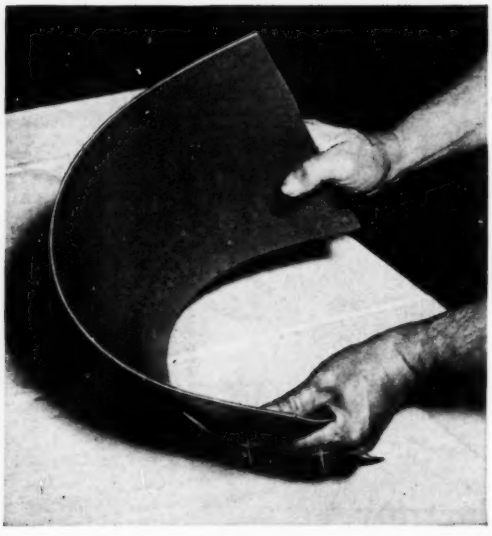


SAWING—operator is using standard band saw to saw plate made from unplasticized EXON 402.



WELDING—operator is shown welding a 6" diameter duct section made of unplasticized EXON 402.

DRILLING—unplasticized EXON 402 forms are drilled easily. Depicted is a flange in the process of fabrication.



BENDING—note how easily unplasticized EXON 402 sheets and plates can be bent and formed to a variety of shapes.

Photographs—Courtesy of American Agile Corp., Maple Heights, Ohio

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PROPERTIES OF EXON 402

Physical Properties of EXON 402 Resin

Form	White Powder
Specific Gravity	1.41
Average Bulking Density, gm./c.c.	0.55
Average Relative Viscosity	2.05

Physical Properties of Unplasticized Laminated EXON 402 Sheets

Tensile, psi	9000-9500
Rockwell Hardness	R105-R110
Heat Distortion, °C.	75
Izod Impact, ft.-lbs./in. @ 25°C.	0.5-1.0
Flexural Modulus, psi	4.8-5.0 x 10^5

Electrical Properties of Unplasticized EXON 402 Sheets

Volume Resistivity, ohm-cm 50 mil plaque at 90°C.	1.3 x 10^{14}
Dielectric Constant 1000 cps—23°C.	3.25
Loss Factor 1000 cps—23°C.	0.072
Dielectric Strength, volts/mil In oil at 26.5°C.—30 mil plaque	725

goes through a minimum in the range 30-45% plasticizer, the better solvents giving lower minima (83). Solvent release becomes easier as the amount or solvent power of the plasticizer increases. The ability to take a satisfactory print or to form a strong bond when electronically sealed is often impaired by secondary plasticizers. Probably just enough exudation occurs to make bonding at the surface difficult.

Plasticizer Types

The esters are by far the most important class of plasticizers for vinyls. At least nine other types of compounds have also been used.

Phosphate Esters — Aryl phosphates are excellent for permanency, low volatility, and flame resistance, but poor at low temperatures. Tricresyl phosphate has long been the standard of this type. Alkyl phosphates are excellent at low temperature, only moderately effective for flame resistance, and poor for marring of finishes. Trioctyl phosphate[6] and tri-iso-octyl phosphate[7] are very similar (97). Tri(2-chloroethyl) phosphate is claimed to impart good water resistance to vinyls but appears to be little used. A series of diphosphates, $(RO)_2P(=O)O(CH_2)_nOP(=O)(OR)_2$ (n=4, 6, 10; R=butyl, hexyl, octyl) served only partially to fufill the hope that the good low temperature properties of trioctyl phosphate could be combined with the good permanence of tricresyl phosphate (73). The most important recent phosphate development is the mixed alkyl aryl phosphate type (46). Octyl diphenyl phosphate is being used extensively. It retains essentially the flame resistance of tricresyl phosphate but is surprisingly non-toxic. In other respects it is a good compromise between tricresyl phosphate and trioctyl phosphate.

Phthalate Esters—The other staple among vinyl plasticizers is the phthalate ester group. "Phthalate" alone means *o*-phthalate and is the only phthalate of commercial significance. The isophthalate (meta) and terephthalate (para) esters are as good (93) and will become important as the oxidation of *m*- and p-xylene is developed commercially. Dioctyl phthalate has been king-pin among the phthalates, being an excellent compromise in all important properties. This leadership is now challenged by di-iso-octyl phthalate which is essentially equivalent (97). Dicapryl phthalate and di-*n*-octyl phthalate are also good. The latter has better low temperature properties than the others and is less volatile. This illustrates the effect of branching which hurts efficiency as well as low temperature flexibility and volatility. The phthalates from the normal C_8, C_9, and C_{10} alcohols are outstanding plasticizers and would be more widely used if the alcohols were more available. The phthalate from the C_9 oxo alcohol (3,5,5-trimethylhexanol) is similar to di-iso-octyl phthalate but less efficient. As the alkyl group increases in size from methyl to lauryl in the di-*n*-alkyl phthalate series, extraction, migration, and low temperature flexibility improve (62). Chlorine in the phthalate ring hurts efficiency and low temperature flexibility but decreases volatility and migration. Second order transition points for Geon 101-plasticizer (2:1) compositions containing the following phthalates are: 2-ethylhexyl −30° C., 2,4,4-trimethylpentyl −7° C., 3,5,5-trimethylhexyl −165° C. (36).

Sebacate, Adipate, and Azelate Esters—Esters of the straight chain dibasic acids are the best available for low temperature flexibility. Of this group, adipates are lowest in cost but sebacates and azelates are lowest in volatility and extraction and often better for compatibility. The octyl and iso-octyl esters appear to be the most popular. Several patents (8,12,50,82,85) describe the esters of benzyl, beta-phenethyl, butyl Cellosolve, cyclopentyl, cyclohexyl, and tetrahydrofurfuryl alcohols. Dibenzyl sebacate[8] is an interesting exception to the rule that aryl groups hurt efficiency and low temperature flexibility. It is much more efficient than dihexyl sebacate (62). Dibenzyl sebacate and di-isobutyl adipate are useful with Saran F-120. Esters of other dibasic aliphatic acids e.g. diglycolic and thiodibutyric acids have apparently not achieved importance in this country.

Glycol Esters—One would expect glycol esters to be very similar to the dibasic acid esters. Such a parallel has not been achieved commercially since the necessary straight chain terminal C_4-C_8 glycols are either too expensive or not available. The polyethylene glycols, $HO(CH_2CH_2O)_nH$, which are actually used, give esters retaining some of the good low temperature flexibility. However, compatibility is diminished and water sensitivity increased. Diethylene glycol and triethylene glycol dibenzoates and dinaphthenates have been patented (49). Ethylene glycol dibenzoate is now being marketed. Mixed aromatic-aliphatic esters of glycols have a favorable balance of properties. The aromatic esters are only fair for flexibility but have lower volatility (34). 1,1,1-Trimethylolpropane trioctanoate is a primary plasticizer whereas the tridecanoate and glyceryl trioctanoate are less compatible (41). Introduction of sulfur as in thiodiglycol esters improves electrical properties without hurting flexibility (37,56). Diethylene glycol bis(butoxyethyl carbonate) is available.

Hydroxyacid Esters—The ricinoleates are the best known members of this class, methyl acetyl ricinoleate and butyl acetyl ricinoleate being commonly used as secondary plasticizers to provide "hand" and drape for film and sheeting. They are good at low temperature and help stability. Propylene glycol diacetyl ricinoleate has improved compatibility and is believed to be the best of the acetyl ricinoleate family to date (74). Citrates such as acetyl tributyl citrate are good. Phthalyl glycolates are extensively used and are non-toxic. Various alkyl and aralkyl lactates and glycolates have been converted to esters of aliphatic mono- and dibasic acids (38).

Monoesters—The monoesters are only secondary plasticizers because one ester group is unable to impart complete compatibility to a molecule of sufficient size for low volatility. They are derived from either a long chain fatty acid or fatty alcohol. They generally impart good low temperature and processing qualities. The oleates have better heat stability and compatibility than the corresponding stearates. An ether linkage helps compatibility as in methyl Cellosolve oleate (3) and dimethyl glycerol ether oleate (101). Cyclic groups also help compatibility as in benzyl stearate, phenyl

(*Continued on p. 178*)

[6] "Octyl" in this article means "2-ethyl-hexyl."
[7] Derived from iso-octyl alcohol which in this article means the oxo alcohol from mixed heptenes.
[8] Also see reference (2) for other aspects of its interesting flexibility properties.

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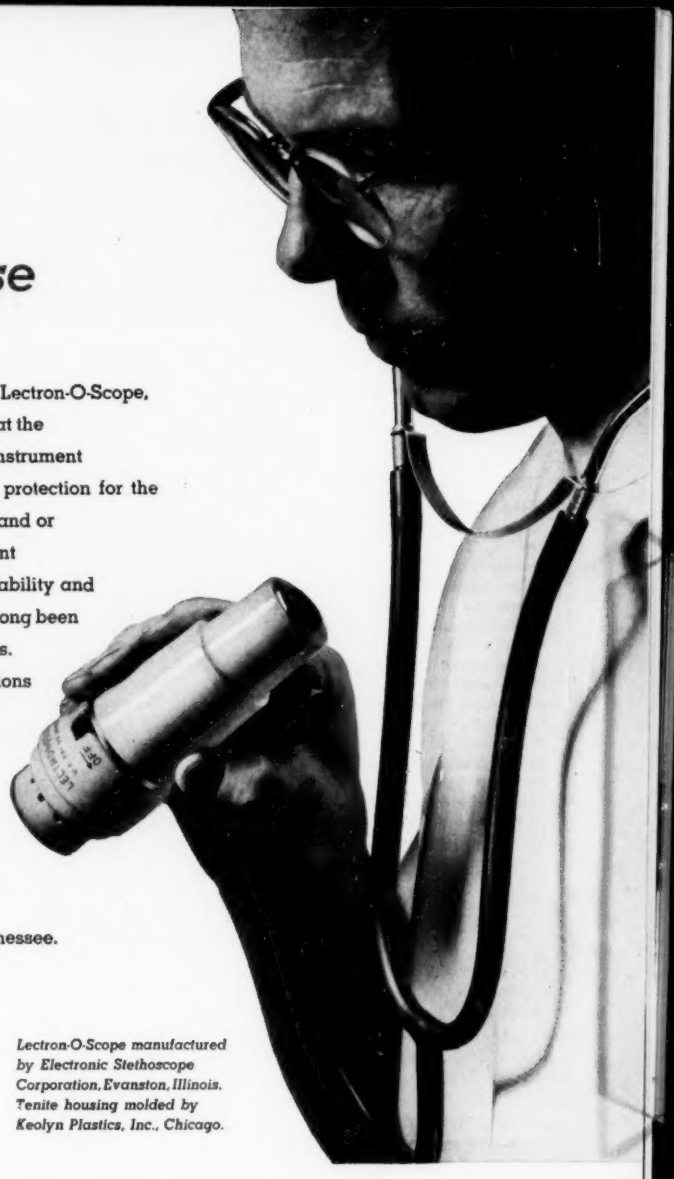

Lectron-O-Scope manufactured by Electronic Stethoscope Corporation, Evanston, Illinois. Tenite housing molded by Keolyn Plastics, Inc., Chicago.

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Effect of Temperature and Composition Upon the Resilience of Elastomers

by E. F. SCHULZ†

The resilience of elastomers at temperatures ranging from 0° to 170° C. has been successfully measured with the Bashore Resiliometer. Such test results are insensitive to sample geometry or finish, are independent of operator effects, and are of good reproducibility. The resilience of elastomers is highly temperature dependent. The resilience versus temperature curves for plasticized polyvinyl chloride resins are characterized by pronounced maxima and minima. These curves are dependent upon the composition; they are influenced by the plasticizer type and the concentration, and by the filler content.

WHEN an elastomeric body is subjected to and relieved of a sudden deformation, a portion of the energy of deformation is immediately recoverable and the remainder is dissipated in damping or hysteresis losses. Resilience has been defined (1)[1] as the percentage of the recovered energy to the energy required to produce the deformation. As used here, resilience is a measure of the immediately recoverable energy, and thus does not take into account creep, delayed elastic, and other time dependent effects.

The resilience characteristics of synthetic elastomers are of importance in gasketing, vibration dampers, and in many other applications where plastics are replacing natural rubber. Measurement of this property, over an extended temperature range and preferably by a simple method, is becoming increasingly important. In many design considerations, the availability of such data has taken the proportions of an engineering necessity.

Various resilience measuring devices, as well as the general subject of resilience, have been treated in numerous publications (1). From the several available techniques a straight-forward rebound resilience tester was selected.

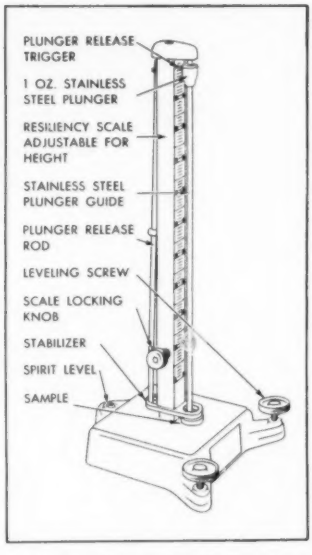

Fig. 1—Precision Bashore Resiliometer

Test Apparatus and Procedure

The rebound resiliometer developed by Bashore (2) was used. This is an inexpensive, portable instrument of simple construction and operation. The instrument measures the rebound of an essentially freely falling weight.

A sketch of the resiliometer is shown in Fig. 1. Resilience is measured by observing the height to which the 1-oz. plunger will rebound when dropped on the sample from a height of 16 inches. The resilience scale is adjustable for different height specimens, and is perpendicular to the base. The steel plunger weight is held by a release trigger which is controlled by a release rod at the back of the scale. Pressure against the release rod allows the weight to drop. The operator observes the number immediately behind the top of the weight at the peak of rebound. The first three readings are disregarded, and the average of the five following read-

Table I—Effect of Specimen Thickness upon Rebound

Thickness of specimen	Rebound at 25° C. Compound A	Compound B	Compound C
in.	%	%	%
0.083	21	—	—
0.165	25	—	—
0.248	28	—	—
0.252	—	11	—
0.268	—	—	12
0.330	28	—	—
0.335	—	11	13
0.402	—	—	14
0.413	27	—	—
0.420	—	12	—
0.469	—	—	14
0.495	26	—	—
0.504	—	11	—
0.536	—	—	15

† Development Dept., Bakelite Co., A Division of Union Carbide and Carbon Corp.
[1] Numbers in parentheses refer to references beginning p. 185.

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ings is reported as the resilience reading.

Measurements between 0° and 60° C. were made in available controlled temperature rooms after overnight conditioning of sample and tester. At temperatures above 60° C. the resiliometer was installed in a circulating-air oven provided with a glass inner door. A remote control triggering and resetting mechanism was used to actuate the plunger externally without disturbing the temperature equilibrium in the oven. Specimen temperature was measured with a thermocouple imbedded between sheets of the specimen stack. This provided a continuous means for following the temperature rise and permits stabilization at the desired level.

Test Variables

Davis and Blake (3) caution against the influence of specimen geometry, age, surface, and other factors upon resiliometer test results when testing rubbers. The effect of these and other possible variables upon resilience measurements of plasticized vinyls was investigated. Most of the investigations were conducted on three concentrations of dioctyl phthalate plasticizer (DOP) compounded with vinyl chloride-vinyl acetate copolymer resin (VYNW). The 25, 35, and 45% plasticizer concentrations have been designated as compound A, compound B, and compound C, respectively, in the included tables.

Table II—Effect of Specimen Diameter upon Rebound

Compound	Rebound at 25° C. 1 in. diameter	1.5 in. diameter	2.0 in. diameter
	%	%	%
A	30	29	27
B	12	11	12
C	13	13	13

Specimens of various thicknesses were tested. These data are shown in Table I. Although initially an increase in rebound is observed with increasing thickness, the data become essentially independent of specimen thickness at 0.5 inch. This thickness was, therefore, used throughout this work and is the recommended minimum for all measurements. These results parallel Bashore's findings for pure gum rubber (2). Test results were also found to be independent of specimen diameters ranging between 1 and 2 inches. This will be seen from Table II. For reasons of convenience and standardization, 1.5-in.-diameter specimens were used.

It is generally not convenient to mold specimens in ½-in. thicknesses. Consequently, disks of thin sheeting were superimposed to ½-in. thickness and test results compared to data obtained on a single disk of the same thickness. Such a comparison is shown in Table III. Good agreement exists between the two types of specimens. Solid or composite specimens can, therefore, be used interchangeably.

Table III—Comparison of Rebound of Composite and Solid Specimens

Specimen[a]	Rebound at 25° C. Compound A	Compound B	Compound C
	%	%	%
Composite	29	12	13
Solid	27	11	13

[a] Thickness: 0.5 inch.

Possible effects due to type of sample finish have been suggested by Hemmler (4). Comparative tests between press polished and matte finished samples, however, did not exhibit any significant difference. Comparative data for plasticized vinyls are shown in Table IV.

Table IV—Effect of Finish upon Rebound

Compound	Rebound at 25° C. Press polished	Matte
	%	%
A	32	31
B	18	19
C	16	17

Good agreement between operators was exhibited by resilience data of nine different compounds determined by five operators. A statistical analysis of these data substantiated the absence of operator effects.

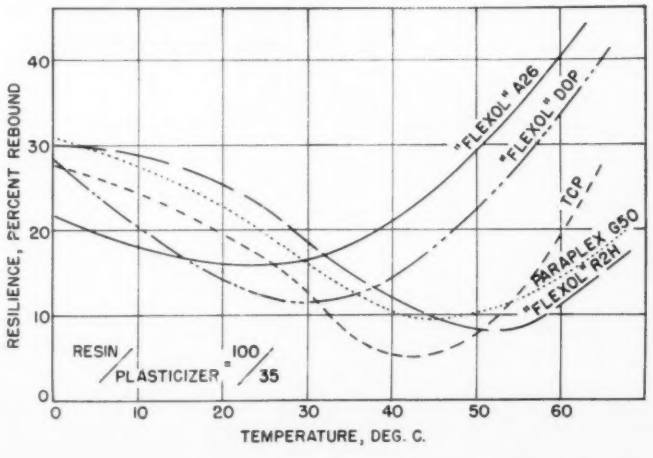
An estimate of the over-all reproducibility of rebound measurements at room temperature was made from an analysis of 85 average test results. These data indicate a precision of ±3% rebound with 95% certainty. The precision of stiff materials, however, generally appears to be poorer.

Cursory examination of aging effects upon resilience, for samples studied during the initial 17 days, did not show any noticeable trend.

Temperature Effects

The marked temperature sensitivity of most elastomers is demonstrated by Figs. 2 and 3. Here large changes in resilience are noted for the rubber compounds between 0°

Fig. 2—Temperature-resilience characteristics of various plasticizers of VYNW resin



and 60° C. The polyvinyl chloride formulations exhibit pronounced and apparently characteristic resilience minima in this temperature region. The resilience behavior of the vinyls is shown to be dependent upon the type of plasticizer that is used.

At elevated temperatures, in the case of DOP plasticized VYNW compounds, the resilience goes through a

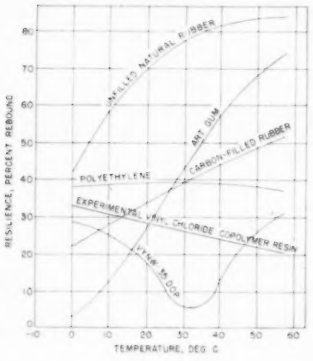


Fig. 3—Temperature-resilience characteristics of various elastomers

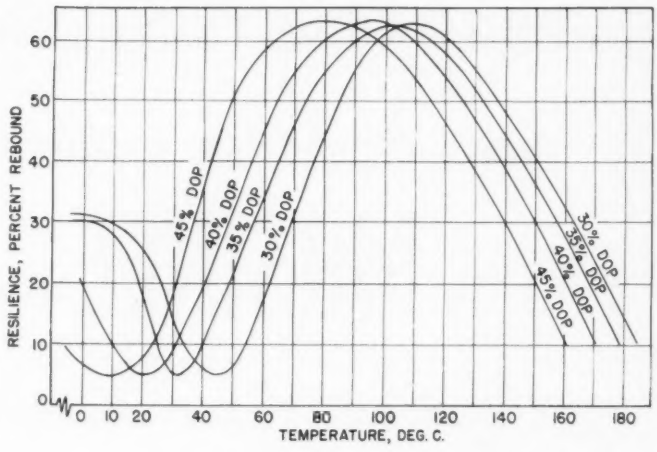


Fig. 4—Effect of plasticizer concentration upon the resilience-temperature characteristics of DOP plasticized VYNW resin

maximum and gradually decreases until at 180° C. excessive softening of the specimens precludes further measurements. Thus, with increasing temperature from 0° to 170° C., the resilience first passes through a sharp minimum or dip, then increases more gradually to a less critical peak, and finally declines until nearly all resiliency is lost with increasing flow of the material. A family of such curves is shown in Fig. 4. The displacement of these curves is a function of sample composition.

Effect of Composition

The dependence of resilience upon plasticizer concentration has been shown, over a limited temperature increment, by Rider, Sumner and Myers (5) and by Friedlander (6). Figure 4 illustrates the resilience characteristics of various concentrations of DOP plasticizer in VYNW resin over an extended temperature range. The maximum and minimum rebound points are at approximately the same resilience level for all concentrations of DOP. But an increase in plasticizer concentration will lower the temperature of maximum and minimum rebound and in effect will displace the resilience curve to a lower temperature level. This shift is essentially parallel to the temperature axis.

The high temperature resilience of VYNW/DOP systems is reduced with increasing "Multifex" filler content. This is demonstrated in Fig. 5 where the DOP concentration has been adjusted to give approximately the same room temperature hardness. The same characteristic decrease in resilience is observed with increasing temperature for the filled as well as the unfilled VYNW/DOP compositions in this temperature range. However, the rate of decrease is lower for the filled material.

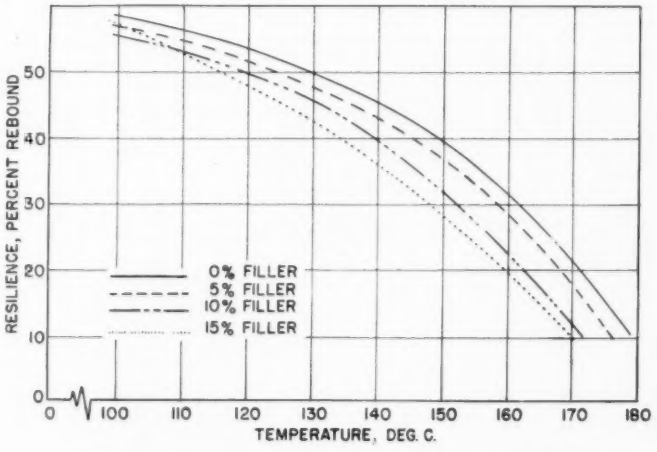


Fig. 5—Resilience-temperature characteristics of Multifex ($CaCO_3$) filled VYNW resin

A resilience comparison from 100° to 170° C. of several polyvinyl chloride resins and a vinyl chloride-vinyl acetate copolymer resin compounded with 35% DOP is presented in Table V. The data demonstrate that statistically significant differences in re-

(*Continued on p. 185*)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PLASTICS DIGEST*

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General

REPORT ON NOMENCLATURE IN THE FIELD OF MACROMOLECULES. International Union of Pure and Applied Chemistry. J. Polymer Sci. *8*, 257-77 (Mar. 1952). The definitions and nomenclature in the field of macromolecules adopted by the Council of the International Union of Pure and Applied Chemistry are given in this report. Definitions of a general nature as well as those used for materials and in certain special branches of this science are included. Rules for naming new polymers are also given.

Materials

ASPHALT, A COLLOIDAL MATERIAL. R. N. Traxler and J. W. Romberg. Ind. Eng. Chem. *44*, 155-8 (Jan. 1952). Asphalts from widely different sources may have distinctly different physical properties. An investigation was made to correlate this variation in physical properties with colloidal characteristics. Solubilities in organic solvents, microscopical examination, rheological properties, and the dispersion and flocculation of asphaltenes by petrolenes (which compose the continuous phase of the asphalt) were employed to distinguish between asphalts of different colloidal characteristics. Data are presented which show that correlations exist between the colloidal characteristics of representative asphalts and the physical properties that determine their usefulness in service.

COLORING OF POLYSTYRENE MOLDING MATERIAL. S. D. Eagleton and H. B. Kingsley. Brit. Plastics *25*, 120-25 (Apr. 1952). The essential stages in the coloring of polystyrene molding powder are a preliminary mixing of the coloring materials and polystyrene granules, followed by the incorporation of the colors into the polystyrene mass at a high rate of shear and at temperatures of 150° C. or over, when the polystyrene is in the visco-elastic state. In general, the final mixing process is carried out using mills or extrusion machines and the product is granulated before being fed to the injection molding machine, but recently a process has been developed whereby the final coloring process actually takes place in the cylinder of the machine. The mixing processes are described in detail. The dispersibility, heat stability, lightfastness, distribution, and tinctorial strength requirements are discussed. Various types of inorganic pigments and organic dyes used in coloring polystyrene are compared. Spectrophotometric curves are used for color matching. The highest quality molding powder is only obtainable by careful and consistent attention to detail in the choice of coloring materials and in the processing to be used.

Applications

PLASTICS APPLICATIONS IN HOUSEHOLD APPLIANCES. F. A. Martin. SPE J. *8*, 28-35 (Mar. 1952). A bibliography of articles in which plastics applications in household appliances are described is presented. The bibliography covers the years 1919-28 and 1937-50.

MULTI-WAY PVC TUBES FOR GASES AND LIQUIDS. Plastics (London) *17*, 121 (May 1952). Pipes made of polyvinyl chloride are used to convey gases, air, sea water, and clean liquids. Construction details of these reinforced pipes are given.

Molding and Fabricating

A NEW MACHINE FOR LARGE POLYTHENE MOLDINGS. Brit. Plastics *25*, 10-13 (Jan. 1952). An injection molding machine for molding large parts from polyethylene is described.

PROGRESS IN DIP-MOLDING WITH PVC PASTE. Plastics (London) *17*, 117-20 (May 1952). Techniques for molding various items from polyvinyl chloride paste by dipping operations are described.

Properties

PROPERTIES OF HONEYCOMB CORES AS AFFECTED BY FIBER TYPE, FIBER ORIENTATION, RESIN TYPE, AND AMOUNT. R. J. Seidl, D. J. Fahey, and A. W. Voss. National Advisory Committee for Aeronautics Technical Note No. 2564, 36 pp. (Nov. 1951). The effect of fiber type, fiber orientation, resin type, and resin content on the strength properties of honeycomb core structures was determined. The structures examined were made from nonwoven cotton, nonwoven rayon, and paper. Some cores had the principal fiber grain parallel to and others had it perpendicular to the cells of the honeycomb. One or more resins in varying amounts were used to impregnate or bond the three materials. Structures made from paper had considerably greater tensile, compression, and shear strengths than cores made from either cotton or rayon. Higher tension and compression strengths were obtained with honeycomb structures in which the principal fiber grain was parallel to rather than perpendicular to the axes of the cells. Honeycomb structures made from each of the three fiber materials retained more than 75% of their dry tensile strength after complete saturation in water. Cotton retained a higher percentage of its strength upon wetting than paper, and rayon retained the least. In general, the highest strength values (adjusted to a common specific gravity) were obtained from structures in which the pretreated corrugated sheets were held together with a small amount of a phenolic adhesive and the assembled core was saturated with an alcohol-soluble phenolic resin. The effect of increases in pretreating-resin content on the increase in strength properties was more noticeable for structures tested in the water-soaked than in the dry condition.

FATIGUE OF SANDWICH CONSTRUCTIONS FOR AIRCRAFT. F. Werren. Forest Products Laboratory Report No. 1559-J, 9 pp. (Apr. 1952). Tests were made to determine the shear fatigue properties of a sandwich panel with facings of glass-fabric laminate and a core of alkyd iso-

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cyanate foamed in place. Repeated tests were made at a ratio of minimum to maximum loading of 0.1. The results of the tests indicate that the fatigue strength at 30 million cycles is about 30% of the static strength for the condition of loading used.

ULTRASONIC STUDIES OF POLYMETHYL METHACRYLATE. J. L. Melchor and A. A. Petrauskas. Ind. Eng. Chem. *44*, 716-19 (Apr. 1952). The velocity of sound versus temperature in polymethyl methacrylate was studied by a pulsed ultrasonic beam method. Measurements were made at frequencies of 0.5, 1, 2, 5, and 10 mc., over a temperature range from 15° to 105° C. Breaks were observed in the curves of velocity of sound versus temperature. The temperature at which these breaks occurred did not change strongly with frequency. A slight shift to higher temperatures with increase in frequency was observed in the region from 0.5 to 5 mc. The observed change in transition temperature over the frequency range covered was only 2° or 3° C., and this is barely outside the experimental error. Thermal expansion curves obtained for the same samples of polymethyl methacrylate exhibited a break at approximately the same temperature. Attenuation measurements at frequencies of 0.5, 1, and 2 mc. show an increase in attenuation with increasing frequency and temperature.

Coatings

PHOSPHATE COATINGS FOR MILITARY PRODUCTS. N. P. Gentieu. Product Eng. *23*, 183-90 (Feb. 1952). The properties and applications of corrosion-inhibiting phosphate coatings for use as primers for organic finishes are reviewed. Data on the military specifications which require their use or specify them are tabulated.

Testing

ABRADOFLEX - ABRASION RESISTANCE TESTER. M. C. Shaw. ASTM Bulletin No. 180, 49-52 (Feb. 1952). A wearability testing machine was developed for asbestos textiles and other fabrics, particularly of the heavier grades. The destructive actions of abrasion, flexing, and creasing are simultaneously applied to cloths under test and the resulting degradation evaluated in terms of loss in tensile strength. The Abradoflex rating index derived from these determinations serves to indicate the relative wearability of the textiles so tested.

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER MATERIALS AT LOW TEMPERATURES. J. Z. Lichtman and C. K. Chatten. Anal. Chem. *24*, 812-18 (May 1952). A torsional apparatus and a hardness indentation tester are found to be essentially equivalent for use in evaluating the stiffness characteristics of elastomers over a range of low temperatures. The torsion apparatus, requiring the use of relatively small specimens, facilitates carrying out various conditioning cycles on a material such as liquid immersion or atmospheric aging. The indentometer, on the other hand, permits the employment of larger size specimens or samples such as relatively thick gasket stocks. The individual advantages in each apparatus would determine the choice to be made in selecting a test method for a particular specification.

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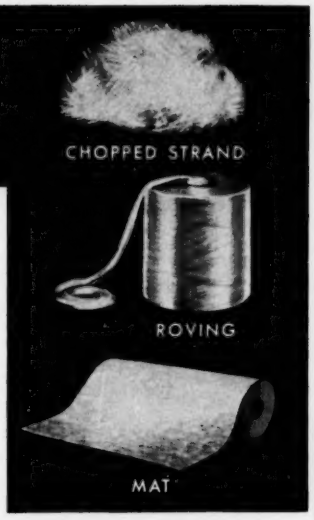

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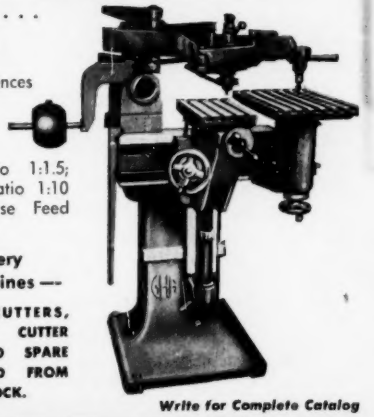

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

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CAST RESINS. W. J. Taat and R. W. van H. Korndorffer (to Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk). U. S. 2,591,634, Apr. 1. Selenium dioxide-containing phenolic casting resins.

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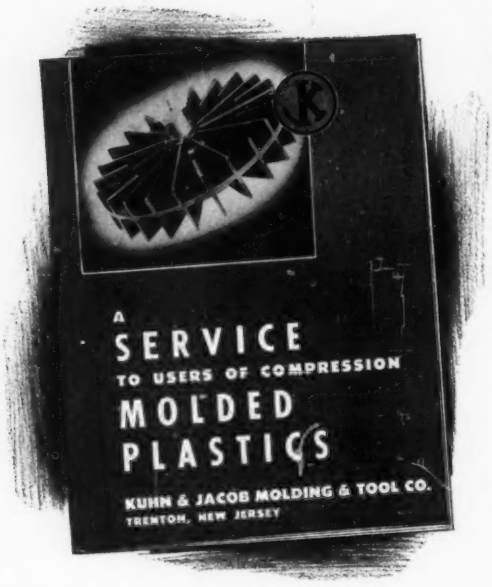
STYRENE POLYMERIZATION. H. F.



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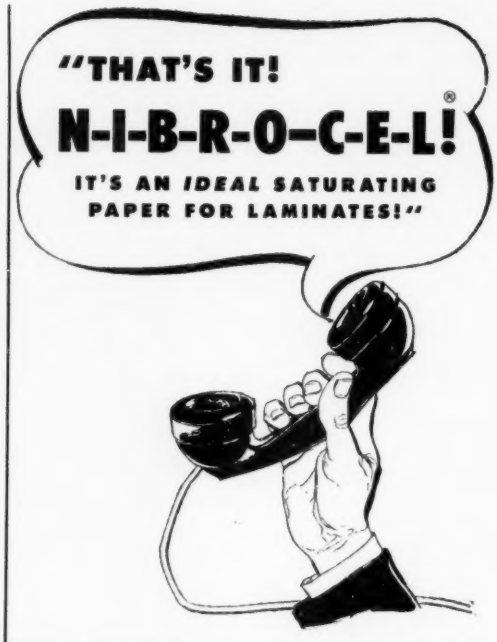

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POLYMERS. P. J. Flory (to Wingfoot). U. S. 2,594,145, Apr. 22. Reaction products of an N-acyl polyimide of a polycarboxylic acid with a polymer containing hydroxy or amino radicals.

FIBERS. J. C. Cowan, C. D. Evans,

and L. L. McKinney (to U. S.). U.S. 2,594,293. Apr. 29. Acrylonitrile-protein derivative fibers.

INTERPOLYMERS. R. J. Wolf (to B. F. Goodrich). U. S. 2,594,375, Apr. 29. Interpolymers of vinyl chloride, a higher alkyl acrylate, and a mono-iso olefin.

MELAMINE. M. Kosmin (to Monsanto). U.S. 2,594,452. Apr. 29. Methylol melamine derivatives.

RESINS. H. S. Bloch and R. B. Thompson (to Universal Oil Products). U.S. 2,594,537, Apr. 29. Resins from aromatic polyketones and polyamides.

POLYMERIZATION. E. G. Howard, Jr. (to Du Pont). U. S. 2,594,560, Apr. 29. Low temperature polymerization of ethylenic compounds.

POLYSTYRENE. E. E. Novotny and G K. Vogelsang (to Borden). U. S. 2,594,579, Apr. 29. Thermosetting polystyrene interpolymers.

NITROGENOUS RESINS. G. K. Vogelsang (to Borden). U. S. 2,594,601, Apr. 29. Infusible nitrogenous resins.

COPOLYMER. C. H. Swart (to General Tire and Rubber). U. S. 2,594,824, Apr. 29. Butadiene methyl-o-chlorocinnamate copolymer.

INTERPOLYMERS. P. O. Tawney (to U. S. Rubber). U. S. 2,594,825, Apr. 29. Interpolymers of di-(beta-allyl-oxyethyl) fumarate and allyl alcohol.

PLASTIC TUBING. J. Bailey (to Plax). U. S. 2,594,842, Apr. 29. Method and apparatus for producing plastic tubing.

PELLETIZING. L. K. Fehrenbach (to Plax). U. S. 2,594,894, Apr. 29. Apparatus for pelletizing thermoplastic resin.

POLYMERIZATION. J. M. Grim (to Koppers). U. S. 2,594,913, Apr. 29. Suspension polymerization employing phosphates of submicroscopic size as stabilizers.

RESINS. J. D. Nelson (to General Electric). U. S. 2,594,979, Apr. 29. Adhesive containing epichlorohydrin, bis-(4-hydroxyphenyl)dimethylmethane, and methylene bis-(4-phenyl isocyanate).

POLYMERS. D. E. Adelson and H. Dannenberg (to Shell). U. S. 2,595,214, May 6. Polymers of allyl alkyl carbonates.

NEW MACHINERY AND EQUIPMENT

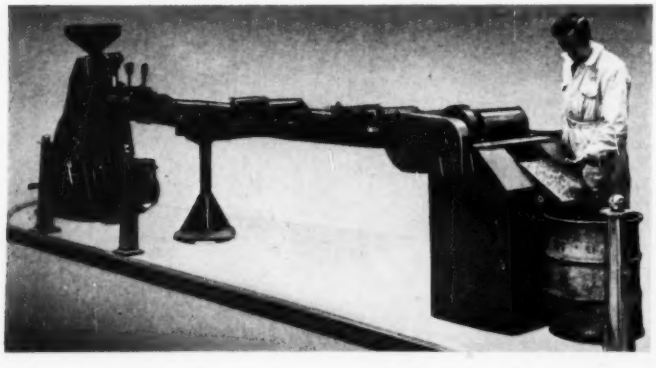
EXTRUDER-PELLETIZER — Primary modifications for this machine (R.C. 65 Mark I) designed by R. H. Windsor Ltd., Leatherhead Rd., South Chessington, Surrey, England, for coloring, extruding, and pelletizing styrene, is the separation of the control cabinet from the machine proper and the inclusion of a vibrating chute hopper device.

The material is extruded as ¼ in. sq. filaments by the die, which is integral with the adaptor plate. These filaments are fed onto a conveyor belt running at a faster rate than that at which the filaments are being extruded. This stretches or orientates the filaments to approximately ⅛ in. sq. sections. A series of rollers press the filaments against the belt so that they do not slip. Another feature is a grill type separator which is located at the beginning of the belt to keep the filaments separate from each other and prevent them from touching and possibly sticking together.

The filaments are delivered by the belt to a rotary cutting device which produces a final cube of ⅛ in. The cutter, which is synchronized with the belt, is driven by a 3 hp. motor, driving through a variable speed device, which in turn drives the cutter by a heavy roller chain.

Filaments from extruder-pelletizer (above) are stretched on conveyor belt (below); belt leads to rotary cutter

PRECISION CHARGING UNIT—A weighing device designed to charge plastic molding machines has been introduced by Glengarry Processes, Inc., Bay Shore, N.Y. The unit is mounted on the machine, replacing the present feed mechanism, and consists of four basic units—the supply hopper, an electric vibratory feeder, a weigh bucket mounted on a beam, and a solenoid operated gate on the weigh bucket. In operation, the feeder conveys the material from the supply hopper to the weigh bucket until a predetermined amount of material has been received. The power to the feeder is then automatically cut, thus stopping the flow of material. The gate on the weigh bucket is opened by the solenoid and the material drops into the chamber.

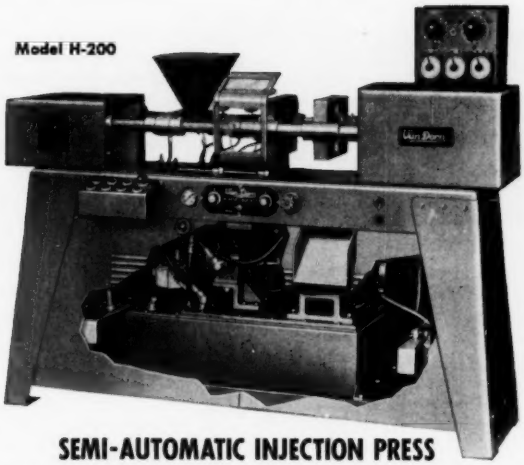


REINFORCED PLASTICS MOLDING PRESSES—A new, medium-priced line of low-pressure presses especially designed for the molding of reinforced plastics has been announced by Erie Engine & Mfg. Co., Erie, Pa. The presses are available in three standard platen sizes—32 by 36 in.; 42 by 49 in.; 40 by 76 in.—but other sizes can be made to suit customer's requirements.

Low-pressure press designed to be used for the molding of reinforced plastics

PRINTING PRESSES—Four-color rotogravure press (Model 4-8), which with the addition of four extra printing nips can print up to eight colors on surface prints, has been announced by Lembo Machine Works, Inc., 248 E. 17 St. Paterson 4, N.J.

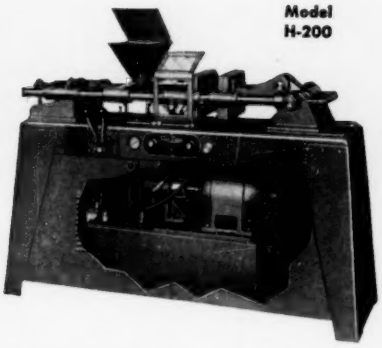
Both surface and roto presses are built by the company with individual neoprene covered impression cylinders or a large diameter central cylinder to suit desired requirements. Handwheel or motor register control may be obtained as optional equipment on the surface presses up to 12 colors. The surface print presses are available up to and including 80 in. widths.



Model H-200

SEMI-AUTOMATIC INJECTION PRESS

2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.



Model H-200

Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

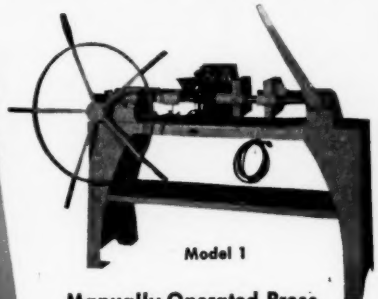
VAN DORN
Plastic Equipment

COSTS LESS to Buy...to Operate!

Van Dorn presses are *unexcelled in efficiency* and *unequalled in economy* on the innumerable jobs where a 2-oz. injection is ample. Costwise, Van Dorn presses are outstanding for these reasons:

1. **Surprisingly low in price**
2. **Operate 8 hours for a few dollars**
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*

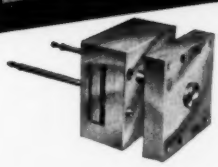


Model 1

Manually Operated Press
1-oz. capacity. Ideal for smaller jobs, experimental work, training.

Plastic Grinder
Grinds up rejects, waste, etc., for re-use. Ruggedly made, easily cleaned.

Model G-100



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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Handbook of Engineering Fundamentals," edited by Ovid W. Eshbach.

Published in 1952 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1324 pages. Price $10.00.

New developments and changes in emphasis in various branches of technology are incorporated in this revised engineering reference book. Among the chapters which appeared in the first edition and which have been rewritten for this second edition are those covering mathematics, thermodynamics, fluid mechanics, electricity and magnetism, engineering materials, and engineering law.

"Techniques of Plant Maintenance —1952," Proceedings of the annual Plant Maintenance Conference and Show.

Published in 1952 by Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. 182 pages. Price $6.00.

Illustrated with charts, diagrams, graphs, and tables, the texts of papers read at the 1952 Plant Maintenance Conference and Show, provide a cross-section of current industrial engineering thought on maintenance problems. Papers are divided into such general sections as costs, inspection methods and records, planning and scheduling maintenance work, and lubrication. Each is followed by a detailed question-and-answer section. Separate chapters discuss maintenance of electrical equipment; plant buildings; training maintenance workers and supervisors; project preparation; and cost control.

"Measurement and Control of Temperatures in Industry," by R. Royds.

Published in 1952 by Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N. Y. Price $5.00.

Latest developments in temperature measurement and control are discussed as they apply to various industries. The methods and equipment available for temperature measurement in each particular range are enumerated. Detailed consideration is given to such problems as standardization and automatic control of temperatures; improving the quality and reliability of industrial products; increasing production rate; and saving fuel and labor by the application of automatic temperature controls.

"Synthetic Resins and Allied Practices," edited by R. S. Morrell and H. M. Langton.

Published in 1952 by Oxford University Press, 114 Fifth Ave., New York 11, N. Y. 747 pages. Price $10.00.

Revised theories concerning the chemistry of the phenol-formaldehyde, amino-formaldehyde, and certain other synthetic resins are included in this third edition. Among the materials covered are the protein and cellulosic plastics; vinyl resins; acrylic resins; coumarone and indene resins; ester gums; phenolic varnish and lacquer resins; alkyd resins; shellac; and petroleum hydrocarbon and rubber resins. References, photographs, tables, formulas, and diagrams are included.

Molding press—Details on the speed, molding action and feed, ejection, and adjustments of the company's Model 800 Press are described and illustrated in a four-page bulletin (No. 513). Designed to handle all thermosetting plastics, including alkyds without press modification, the new model is a fully automatic 15-ton molding press which operates at unusually high speeds. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Precipitated calcium carbonates in reinforced plastics—Superseding an earlier publication on the same subject, this revised 21-page technical reference bulletin reviews the use of two precipitated calcium carbonates (Surfex MM and Kalite) in fabricating reinforced polyester resins. Also summarized are laboratory tests used to evaluate the performance of these materials in terms of the effects of loading on 1) physical properties —flexural, tensile, compression, and impact strengths—and 2) the chemical resistance of a number of commercially formulated polyester resins. Detailed results of these specific analyses are presented in a series of eight tables; other tabular charts give the weighing and cost factors of filled reinforced polyesters and specifications of both Surfex MM and Kalite. *Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.*

National Standardization Conference—Proceedings of the Second National Standardization Conference, held in New York during Oct. 1951, are available in this 64-page booklet, "Strengthening America Through Standards." Among the subjects covered are standards for engineering schools; industrial standards for defense production; electrical standards as an aid to purchasing; and the operation of ASTM. The booklet is obtainable for $1.00 from *American Standards Assoc., 70 E. 45 St., New York 17, N.Y.*

Acrylic plastic enclosures—A 30-min., 16 mm. color sound film currently being used by the Air Force and the Navy as an official training film on the maintenance of transparent acrylic plastic enclosures on aircraft, is also available for non-military showings. The film covers essential operations in the care and maintenance of acrylic plastic. Included are scenes showing approved methods of cleaning, buffing, polishing, and patching; use of bandsaws, circular saws, and drills; proper storage; simple forming techniques; the installation of aircraft windows; and the application and removal of protective coatings on canopies, domes, and other transparent enclosures. *Plastics Dept., Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Laminating glues—Gluing of laminated wood keels, ribs, and other boat timbers for Navy use is analyzed in this special 8-page bulletin (No. 87). All phases of marine service gluing to military specifications with Cascophen resin glues are reviewed. The booklet also contains a

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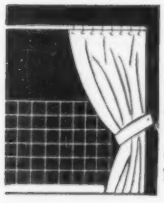

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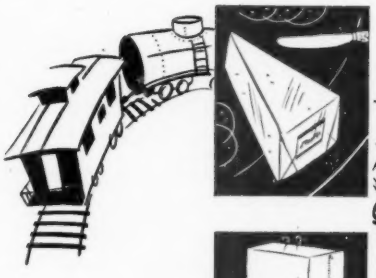

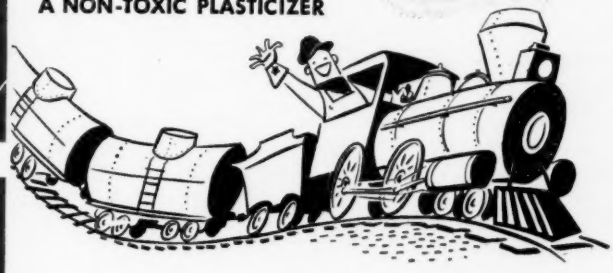

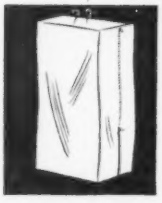

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For additional information about Acetyl Tributyl Citrate and other Pfizer Citrate Plasticizers write for the booklet "Pfizer Citric Acid Esters as Plasticizers."

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guide to correct possible faulty gluing procedures. Accompanying data sheets list the company's resin glues approved for marine laminations. *Borden Co., Chemical Div., 350 Madison Ave., New York 17, N. Y.*

U.S. Polymeric Chemicals—Current products of this company, which specializes in custom impregnation of low and high pressure laminating stocks, are described in this brochure as to properties, advantages, and applications. *U.S. Polymeric Chemicals, Canal and Ludlow Streets, Stamford, Conn.*

Package and sealing table—Described in this folder are the advantages of a heavy-duty marble-top table with inset hotplate for sealing plastics film packages. *Cleveland Lathe & Machine Co., 676 Broadway Ave., Cleveland 15, Ohio.*

Plastics surfacing—Step-by-step procedures for fabricating Textolite Monotop plastics surfacing are pictorially explained in this 16-page shop manual (CDL-59). Information covered in the fabricating guide includes tools required, mitered corners, butt joints, sink cut-offs, and end caps. *General Electric Co., Pittsfield, Mass.*

Coated abrasive belt polishing—Advantages of coated abrasive belt polishing methods are presented in this 24-page illustrated booklet. *Behr-Manning Corp., Troy, N. Y.*

Milling equipment—Descriptions of milling equipment for the chemical and plastics industries are contained in this 16-page bulletin. Products covered include the AirSet roller mill; straight-line, single-flow roller mills; flaking and compounding mills; all-metal gyratory sifters; and rotary dryers and coolers. *Allis-Chalmers Mfg. Co., 1163 S. 70 St., Milwaukee, Wis.*

Low-pressure laminates—Company facilities for manufacturing low-pressure laminates are described in this 12-page booklet entitled, "Winner Makes All." Facilities include equipment for matched-metal, pressure bag, and vacuum molding in plastics. Finished plastics applications range from motor boats, army assault boats, aircraft parts, and dye tanks to typewriter cases, highway signs, radar housings, molded chairs, and shipping containers. *Winner Mfg. Co., Inc., Trenton 3, N. J.*

Tile estimator—Detailed instructions for estimating the amount of material needed to install Hako Asphalt Tile Floors and Vinylflex Plastic Floor Tile are given in this folder. Eight installation designs are suggested. *Hachmeister-Inc., Pittsburgh, Pa.*

Plant maintenance film—Efficiencies and economies effected by employing fork-lift trucks and towing tractors in plant maintenance operations are explained in a 15-min. movie called, "Serves You Right!" This black-and-white film with sound features the use of industrial radio in the operation of a fork-truck fleet working in both plant maintenance and materials handling activities. *Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*

Fractional horsepower motors—Selection and application of fractional horsepower motors in the home, farm, factories, and offices are described in a 35 mm. black-and-white, sound slidefilm, the tenth in a visual motor selection course series put out by the company. This 21-min. film shows the different types of fractional horsepower motors and, with the aid of charts, graphs, and cartoons, outlines the basic considerations in selecting and applying any one of these motors, such as determination of motor horsepower, electrical characteristics, control equipment required, and mechanical design features. *General Electric Co., Schenectady 5, N. Y.*

Metal working shaper—Designed as a manual for the company's 7-in. shaper, this 32-page handbook covers the set-up and operation of the metal working bench shaper. Photographs, diagrams, and exploded views show the internal parts of a shaper, how to grind differently formed tool bits for shaper cuts, and how to handle a variety of job set-ups used in shaper work. The manual is available for 25¢ from *South Bend Lathe Works, South Bend 22, Ind.*

Wood research—A survey of the effect of wood research at Virginia Polytechnic Institute is summarized and illustrated in this 24-page booklet. Some of the developments of the past ten years include plywood plate girders; molded plywood staircases; mass production of plywood pipe, tubing, and drums; and the molding of wood waste into core panels for furniture. *Virginia Polytechnic Institute, Wood Research Laboratory, Blacksburg, Va.*

Precision measurement—Designed for use by schools, libraries, and other educational institutions, this 63-page booklet outlines the development of precision measuring instruments. Progress in measurement is traced from mankind's first crude rules and yardsticks to today's extremely accurate devices. *General Motors, Dept. of Public Relations, Detroit, Mich.*

Metallic stearate—The application and reaction of metallic stearates as a lubricant for phenolics, melamine, urea, polystyrene, vinyl, Furan, and cold molded plastics is described in this technical data sheet. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Styrene modified alkyds—Styrene modified alkyd-type resins, which can be formulated as baking enamels or as air drying enamels, are described in this 14-page technical data report. Typical formulation and procedure for performing the styrenation are included in the report. Also discussed are the effects of catalyst type and amount and the ratio of alkyd solids to styrene monomer on the styrenation rate and product characteristics. *Monsanto Chemical Co., Development Dept., Texas Div., Texas City, Tex.*

Aldehydes—Specifications of four aldehydes and a brief summary of their more important uses are offered in this 4-page technical bulletin. These aldehydes are acetaldehyde, crotonaldehyde, *n*-butyraldehyde, and isobutyraldehyde. *Tennessee Eastman Co., Kingsport, Tenn.*

Tabletting presses—The company's complete line, including single-punch, rotary, mechanical, and hydraulic, tabletting presses for plastics preform, pharmaceutical, and general industrial production are described in this 22-page catalog (No. 800). Detailed data on frames, shaft bearings, die tables, drives, hoppers,

and feed mechanisms provide information on the design and fabrication of the presses. A special section of the catalog is devoted to punches and dies. *F. J. Stokes Machine Co., 5500 Tabor Road, Philadelphia 20, Pa.*

Indian Plastics Directory—Manufacturers, distributors, and others connected with the plastics industry in India are classified in this 1952 edition of the Indian directory. Listed, together with their addresses, are manufacturers; machine, mold, and die makers; molders; fabricators; distributors; and dealers in plastics goods. A special section is devoted to foreign machinery and raw materials manufacturers. *P.M.D., Plastics & Machinery Distributors, 4, Upper Chitpur Road, Post Box No. 6703, Calcutta 7, India.*

Notch-sensitivity—Investigations by the University of Illinois in cooperation with the U. S. Navy are reported in this 55-page bulletin (Series No. 398), "A Critical Review of the Criteria for Notch-Sensitivity in Fatigue of Metals." Chapters include a review of notch-sensitivity; interpretations based on concepts of material behavior; analyses of stress conditions; elementary structural unit; stress gradient and stress concentration; failure below surface; statistical theories of fatigue; and homogeneity of materials. The book is available for fifty cents from *The Engineering Experiment Station, University of Illinois, Urbana, Ill.*

Transparent plastic sheet—A clear thermosetting sheet plastic material, Homalite CR-39, is described in this 12-page technical booklet. Included is a comprehensive tabulation of physical, chemical, and electrical properties of the material as compared to cast methacrylate and plate glass. The booklet also covers fabrication of Homalite CR-39, cleaning, forming, routing, and instructions for end use. *The Homalite Corp., 11-13 Brookside Drive, Wilmington, Del.*

Saran rubber—The advantages and characteristics of saran rubber as a corrosion-resistant lining are described in this 8-page bulletin. Physical properties of the material are covered and a comprehensive listing is given of its resistance to chemicals and solvents at room temperature. Photographs illustrate the various uses to which the material can be put. *Saran Lined Pipe, 2415 Burdette Ave., Ferndale 20, Mich.*

Panelyte—Applications for Panelyte, a decorative plastic surfacing material, are outlined and illustrated with full-color photographs in this 8-page folder. The material's use in home, in schools, in business, and as wall panelling are covered. Also featured in the folder are color reproductions of 16 of the 34 finishes in which the material is available. A special section of the folder gives instructions for veneering, fabricating, and applying Panelyte. *Panelyte Div., St. Regis Paper Co., 230 Park Ave., New York 17, N. Y.*

Consultants—The functions and activities of the professional consultant are described in this 32-page book entitled, "The Consulting Chemist and Chemical Engineer in a World Economy." The book is divided into five chapters. The first four detail the extent of the consultants' services, the evaluation of their activities,

the fields in which they specialize, and the remuneration they usually receive. The fifth chapter offers a wide selection of case histories in the plastics, chemical, and other industries, illustrating the type of problem encountered and solved by the consultant. $1.00 per copy from *Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41 St., New York 17, N. Y.*

Plasticizers—Sales specifications, typical properties, compatibility or solubility, and uses are given for each of several plasticizers in this 21-page technical bulletin. The plasticizers covered are triphenyl-phosphate; Dow plasticizer 5, an aryl phosphate; Dow plasticizer 77, an alkylated aryl phosphate; Dow resins 276-V2 and V9, polymolecular resin-plasticizers; and Dow plasticizer 1099, a substituted phenyl ether. *Dow Chemical Co., Plastics Sales Dept., Midland, Mich.*

Neolyn resins—The series of Neolyn resins, which are rosin-derived alkyd-type materials ranging from soft balsamic resins to solid products having a softening range around 88° C., are described in this 16-page technical bulletin. General properties and performance characteristics, as well as specific properties for each of the seven resins in the series, are included. Application data and starting formulations for the use of the resins in adhesives, plastics, lacquers, and organosols are also given. *Hercules Powder Co., Synthetics Dept., Wilmington 99, Del.*

Platens and controls—Principles behind induction heated platens and the advantages inherent in their use are explained in this 8-page booklet. Also discussed and illustrated are the company's temperature selection and control units. Standard sizes, prices, dimensions and weights, and shipping specifications for both the platens and controllers are included. *Berkeley & Young Ltd., Tyseley, Birmingham 11, England.*

Heat seal coatings—Formulations for the heat seal coating of various products are covered in this data sheet (No. C-66). The formulas are designed for use on paper, glassine, aluminum foil, and cellulose acetate. *American Resinous Chemicals Corp., Peabody, Mass.*

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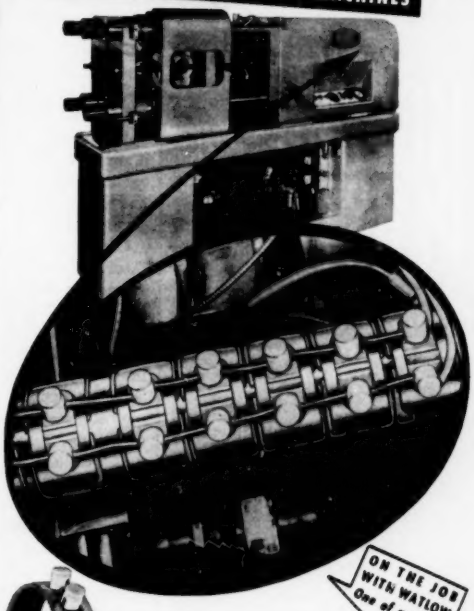

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More and more plastics equipment manufacturers—like the Lewis Welding and Engineering Corp. of Cleveland, Ohio—are specifying Watlow Units as original equipment. There's a reason. Watlow offers:

RATINGS AS HIGH AS 45 WATTS/SQ. IN.

Compact, lightweight design for quick-responding heat concentration . . . minimum temperature lag.

GREATER FLEXIBILITY

Individual bands can be conveniently built up into groups, uniformly distributed in three phases for series, parallel and y-delta connections—as the heat needs dictate. Single burnouts mean minimum down-time and interruption.

LONGER LIFE

Narrow band construction, plus patented clamping band design, assure close contact at all temperatures. This means maximum heat transfer . . . lower internal operating temperature. Result: longer life, fewer burnouts.

WRITE for FREE CATALOG
Strips, bands, cartridges, immersion heaters.

WATLOW Since 1922—Designers and Manufacturers of Electric Heating Units

ELECTRIC MFG. CO.

1364 FERGUSON AVE.

SAINT LOUIS 14, MO.

INTERNATIONAL PLASTICS NEWS*

Activities Around the World of Interest and Importance to the Plastics Industry in the United States

Global organization—Celanese Corp. of America, New York, N. Y., has formed a new global organization known as Celanese Central, S. A., to provide closer liaison with the affiliates of Celanese in all countries except Canada. Kenneth G. Donald has been named president of the new organization.

Canadian Chemical and Cellulose Co., Ltd. was formed some time ago to operate the Canadian activities of Celanese. The foreign affiliates of Celanese other than those in Canada are Celanese Colombiana, S. A. in Colombia, Celanese Venezolana, S. A. in Venezuela, and the following Mexican companies: Celanese Mexicana, S. A.; Viscosa Mexicana, S. A.; Celulosa Nacional, S. A.; and Claracel, S. A.

Molds for export—Comprehensive lists of used molds available for sale or lease abroad are maintained by International Plastics Service, Beverly Hills, Calif. The molds listed are steel molds made in the U. S. which are outmoded or not in use for any reason whatsoever. They are available to foreign molders at costs far below those of producing a new mold.

The International Plastics Service lists are mailed regularly to molders in India, South Africa, South America, Europe, the Near East, and the Far East. The current listing includes molds for such varied items as dinnerware, juice bottles, knobs, barrettes, combs of various types, toys, flashlights, and religious plaques.

German plastics exhibition—Additional details are now available concerning the developments to be exhibited at the first postwar exhibition of the German plastics industry to be held in Duesseldorf, October 11 through 19, 1952. The exhibits will include: the first silicones developed in Germany; the new isocyanate plastics (polyurethanes) and some of their possible applications; the new highly-elastic and oil resistant material called Vulkollan, which is said to have better wear resistance than any known artificial rubber material; electrical insulation materials made of expanded plastics; polyamide foils used in the processing of artificial leather; and the new ethoxylene resins and their uses for bonding metal to metal.

The Duesseldorf exhibition, according to the management, will include practically all the producers and processors of plastics in Germany. Information can be had from the German-American Trade Promotion Office, 350 Fifth Ave., New York.

Philippine sales and credit guide—The second postwar edition of "Market Guide for the Philippines" has just been issued by American Foreign Credit Underwriters Corp., 170 Broadway, New York, N. Y. More than 2500 leading importing, distributing, and manufacturing firms in the Philippine Republic are listed and indivdually rated as to invested capital and credit status. The guide also includes a detailed study of the Philippine market from the viewpoint of the U. S. exporter.

Winding wire—At a recent exhibit in London, British Insulated Callender's Cables Ltd., London, showed some polytetrafluoroethylene winding wire which can be used to wind coils capable of continuous operation at temperatures ranging from −75° C. to +250° C. The insulating film of polytetrafluoroethylene is about 0.001 in. thick and care must be exercised in winding the coils. However, successful windings are being produced by the Royal Aircraft Establishment.

Office in Mexico—Arthur D. Little, Inc., Cambridge, Mass., consulting research and engineering organization, has opened a Latin American office in Mexico City. The office is located at Edificio International 963, Reforma 1, Mexico 1, D.F.

Thermex

COMPACT... PORTABLE...

3-Kilowatt unit

YOU CAN heat up to 2¼ pounds of general purpose material from 80 to 250°F in one minute with the Model 3R THERMEX Plastic Preheating Unit. Much faster mold closing and curing is then possible.

The mold cavity is filled easily and quickly. Uniform softening eliminates hard cores, strengthens the structure.

Operation is simple. When the operator closes the sliding drawer, high frequency power automatically comes on. After the proper pre-set interval, power is shut off by a timer.

The THERMEX Model 3R Heating Unit is compact—occupies less than 4 square feet of floor space. It is light, mounted on rubber-tired casters for portability. All parts are readily accessible.

As the first step in boosting your plastic molding production, write for more information. The Girdler Corp., Thermex Division, Louisville 1, Ky.

THERMEX T. M. Reg. U. S. Pat. Off.

SPECIFICATIONS

Power Data—Power Requirements: 230-volt or 460-volt, 60-cycle, 3-phase. Power Input: 6.3 KVA at 90% power factor. Power Output: 3 KW.
Heating Capacity—Electrode area of 10" by 12" will accommodate preforms up to 3¾" thick. (Special electrodes to provide larger heating area available.)
Controls—Controls on front of cabinet include electrode height adjusting knob, plate ammeter, grid meter, grid adjustment knob, timer, and main circuit breaker.
Construction—Heavy gauge aluminum cabinet contains built-in material-heating compartment with electrode and preform handling tray.
Dimensions and Weight—21" wide, 24" deep, 53¾" high. Weight: 925 pounds gross, 800 pounds net.

the GIRDLER Corporation
Thermex Division

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION From Statistics Compiled

Materials	*Total p'd'n. first 3 mos. 1952*	*Total sales first 3 mos. 1952*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	3,800,268	3,551,896
0.003 gage and over	2,852,394	2,826,594
All other sheets, rods and tubes	1,967,506	1,765,813
Molding, extrusion materials	17,786,312	17,341,908
Nitrocellulose:		
Sheets	1,778,501	1,592,820
Rods and tubes	256,363	314,526
Other cellulose plastics[b]	2,992,832	2,630,180
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	21,884,769	13,684,702
Adhesive	13,082,301	11,785,559
Molding and casting materials[a]	57,717,296	48,669,567
Protective coatings (unmodified and modified except by rosin)	9,385,815	7,988,599
Miscellaneous uses	20,090,795	17,898,852
UREA AND MELAMINE RESINS:		
Adhesives	24,732,247	24,412,910
Textile-treating resins	11,223,684	10,713,903
Paper-treating resins	6,890,921	6,450,362
Protective coatings, modified and unmodified	6,971,662	5,701,070
Miscellaneous uses, including laminating and molding[c]	17,772,426	18,631,460
STYRENE RESINS:		
Molding materials[a]	83,323,247	67,378,719
Protective coatings, modified and unmodified	19,094,638	20,552,994
Miscellaneous uses	21,508,052	16,595,344
VINYL RESINS:[d] Total	157,973,530	132,567,796
Sheeting and film (resin content)[e]		52,358,541
Adhesives (resin content)		4,666,056
Textile and paper-treating resins (resin content)[f]		13,215,148
Molding and extrusion materials (resin content)		47,725,964
Protective coatings (resin content)		5,701,265
Miscellaneous uses (resin content)		8,900,822
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	56,956,619	56,436,405
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS		
Molding materials[a, g]	32,469,725	32,033,580
Protective coatings[h]	26,330,629	25,953,088
All other uses[i]	30,261,061	29,364,479

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [c] Includes sheets, rods, and tubes, and molding and extrusion materials. [d] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [e] Production statistics by uses are not representative, as end-use may not be known at the time of manufacture. Therefore, only statistics on total produc-

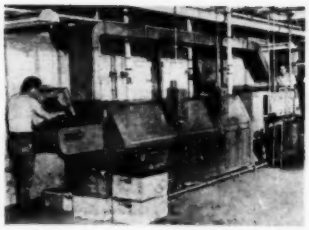
Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS[a] FOR MARCH, 1952, AND APRIL, 1952 by U. S. Tariff Commission

March 1952		April 1952	
Production	*Sales*	*Production*	*Sales*
696,950	737,358	585,028	807,031
699,214	701,057	784,952	847,924
445,011	409,492	510,434	554,046
4,379,876	4,300,800	4,985,271	5,047,068
429,943	394,017	449,985	397,071
49,403	68,063	76,595	69,561
783,993	518,468	683,092	760,221
6,017,084	3,589,169	5,483,175	3,740,262
3,080,536	2,857,524	3,679,763	3,183,458
14,318,217	11,205,461	10,374,004	12,350,798
2,498,007	1,777,184	1,821,724	1,995,281
4,845,769	4,342,639	4,593,622	4,420,644
6,587,661	5,821,007	6,208,034	6,631,125
2,664,983	2,296,202	2,526,468	2,470,774
2,026,269	1,647,727	1,255,312	1,513,955
1,847,045	1,627,022	1,803,133	1,272,529
4,180,497	4,972,030	4,243,333	4,763,146
21,078,070	17,701,462	19,974,724	18,691,952
4,953,417	5,202,697	5,178,098	5,931,923
4,873,115	4,151,453	4,992,331	4,355,129
39,208,362	35,160,275	36,074,096	32,824,635
	14,015,737		12,484,310
	1,213,901		1,257,383
	3,368,306		3,489,612
	12,770,274		11,993,397
	1,401,943		1,636,716
	2,390,114		1,963,217
13,870,609	13,768,940	14,786,043	14,643,767
8,284,717	7,614,083	8,438,771	8,380,560
2,026,230	2,268,615	2,298,675	1,962,078
8,301,736	7,921,247	8,683,728	7,338,209

tion are given. [a] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



Conveyor-type washing machine cleans, rinses, and dries small phenolic parts

Parts Washer

THE problem of removing dust, powder-like chips, and traces of oil from small phenolic parts has been effectively solved by a washing machine currently being used by the Spencer Thermostat Div., Metals & Controls Corp., Attleboro, Mass. Previous to the installation of the machine, which is manufactured by Industrial Washing Machine Corp., New Brunswick, N.J., a degreaser was used. This method proved unsatisfactory for the purpose because of the residual dust that it left on the parts.

The operation of the washing machine is completely automatic, the work being dumped on a conveyor at the loading end and carried through a four-cycle cleaning operation: washing by a heated detergent sprayed over the work from top to bottom; successive rinsings by recirculating hot water; and a final rinsing with fresh water, which is kept free from contamination by having the rinse already used drain off into the second recirculating chamber. The work is dried by high velocity blasts of hot air before being brought by the conveyor to the unloading end.

The detergent used by the company in this operation is Oakite Composition No. 63, at a concentration of 1½ qt. to 110 gal. of solution.

A duct system attached to the machine carries away the vapor generated by spraying the hot solution and the excess heated air from the dryer so that it does not become saturated.

The machine can handle small parts at a rate of 5000 per hr.; its capacity is proportionately high for larger parts.

High-Speed Calender

RECENTLY put into operation by The Goodyear Tire & Rubber Co., Akron, Ohio, is a new, four-roll, inverted L-type calender which is claimed to be the fastest of its type. Designed and built by Adamson-United Co., Akron, the calender is capable of producing at least 120 miles of vinyl, up to 20 mils in thickness and more than six ft. wide, in a 24-hr. day.

The equipment is installed in one plant of the Goodyear Aircraft Corp. and is producing Vinylfilm for use by fabricators of rainwear, drapery materials, shower curtains, garment bags, baby pants, and scores of other plastic items.

Each of the four calender rolls is 92 in. wide and 32 in. in diameter, and weighs in the neighborhood of 25,000 pounds. Housing for the rolls weighs 46,000 pounds. The rolls are of the peripherally drilled type, with a series of longitudinal holes drilled immediately beneath the surface. Through these longitudinal holes circulates the high pressure hot water which is used for controlling the temperature of the surface of the rolls. Automatic temperature control across the drilled rolls accurately maintains the faces at 325° F.

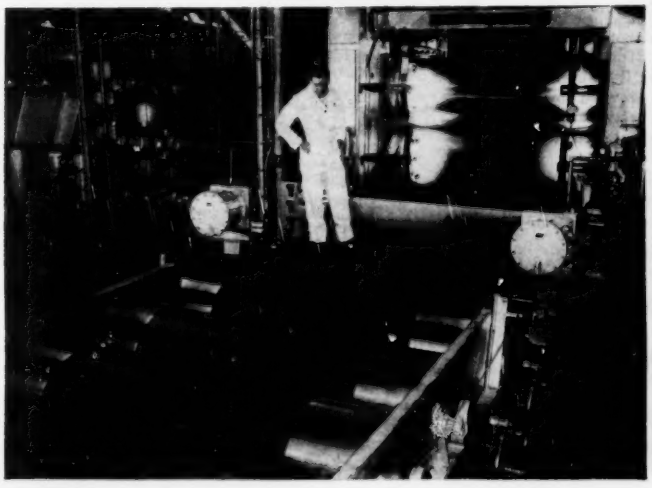
Another completely automatic unit is the turret windup; the operator need only replace the full rolls with empty cores.

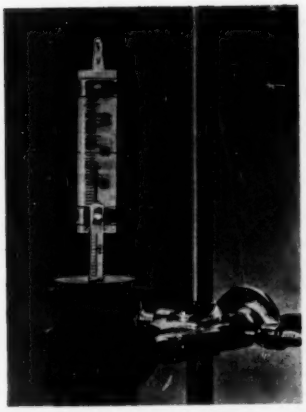
Numerous design features, developed jointly by Adamson-United and Goodyear Aircraft engineers for this particular calender and not available in other types of similar equipment, were incorporated in the machine to insure accurate gage and a superior finish or "hand" to the end product.

Another feature of the Goodyear installation is a yardage counter which gives an electrical signal when the pre-set yardage has been wound. After the signal is given, rotation of the turret, cut-off, and starting of the web on a new core are done completely automatically. The calender also has an electronic metal detector which automatically ejects contaminated material before it can enter the calender and cause damage to the rolls.

Accessory equipment being used by Goodyear with the new installation includes a multiple-drum cooling unit, an automatic turret-type windup, and dual-type embossing equipment. The embossing equipment is suitable for handling in-train embossing of various gages of materials at high speed and is equally successful on very thin materials and on heavier sheetings.

Inverted L-type vinyl calender is capable of producing 120 miles of film in a 24-hr. day. It has four rolls (two visible at rear), each 92 in. wide and 32 in. in diameter





Acrylic magnifier, clamped to thermometer, enlarges 2-in. section of scale

Magnifier

PROPERTIES of acrylic which permit its use as a magnifying lens have been utilized in a detachable enlarger for reading thermometer scales. Equipped with a pair of spring clamps, the unit is snapped onto any standard thermometer and can be moved up or down to magnify any two-in. section of the thermometer scale.

The magnifier is molded for Fisher Scientific Co., Pittsburgh, Pa., by Imperial Molded Products Corp., Chicago, Ill. Acrylic for the unit is supplied by E. I. du Pont de Nemours and Co., Inc., Wilmington, Del. Surface finish of the magnifier is left as-molded because the desired aims—improved readability and visibility—are fully achieved without further polishing or finishing operations.

The attaching spring clamps of the unit are fastened to the thermometer with two 4-36 by ⅛-in. long nickel-plated machine screws. When the magnifier has been snapped into place, the thermometer scale can be read accurately by an operator from as far away as 6 ft., and at a wide angle from the front of the scale. A hairline, engraved across the center of the magnifier's face, can be set at any desired temperature to serve as a reference point. After this reference line has been engraved, it is filled with a highly chemically resistant material, Fisher black Graduation Filler 11-737.

Water Filter

SIX oz. of raw or ordinary tap water can be converted in one minute into chemically-pure, soft water by the Deeminac, a filtering device which is produced and sold by the Crystal Research Laboratories, Hartford, Conn.

The Deeminac consists of two unbreakable polyethylene bottles supplied by Plax Corp., Hartford, Conn. —one acting as a filter container, the other and larger one as a container for ordinary tap water. The filter bottle, with a handy pouring spout at the bottom, fits snugly into the neck of the larger squeezable bottle and is filled with processed ion exchange resins which act upon the water as it is squeezed through from the container. The resulting "distillate" is the equivalent of triple distilled, high test purity water and is suitable for direct use in the batteries of vehicles, in laboratories, in home steam irons, or for any similar application.

The filter can be removed when the squeezable bottle needs refilling or when, after making about 20 gal. of pure water, the filter changes color and has to be replaced.

Deeminac containers are available in three sizes—6, 8, and 16 ounces. Filter refills may also be had in three size classifications—2 oz. for producing 10 to 20 gal. of pure water; 3 oz. for 15 to 25 gal.; and 4 oz. for 20 to 30 gallons.

Filtering device for producing "distilled" water uses polyethylene bottles

Durable, colorful housing for child's toy is molded of cellulose acetate

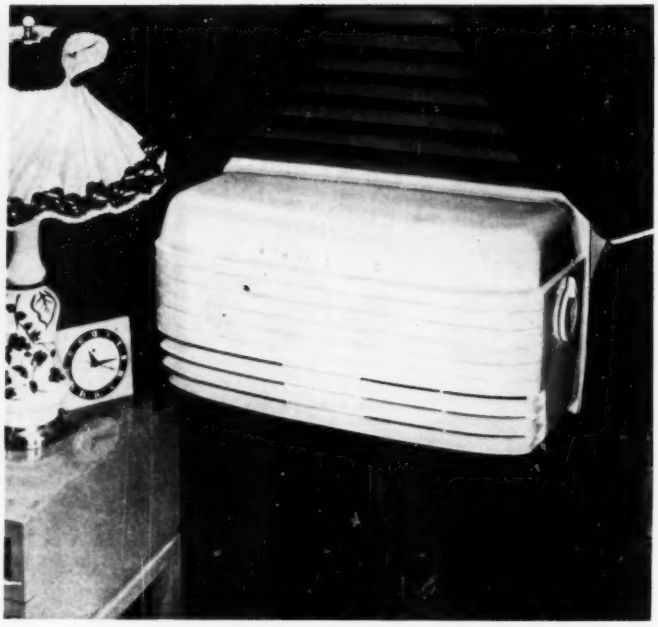
Acetate Yo-Yo

THE popular yo-yo, perennial delight of children everywhere, has been dressed up in a colorful acetate case and converted into a new toy called "Hep," the magic string ball.

The tough, durable cellulose acetate case is molded by Associated Plastic Companies, Inc., Chicago, Ill., in two matching halves which lock together when the toy is being used, but which can be just as easily disassembled to provide access to the yo-yo mechanism located within.

Three different shapes—replicas of a baseball, football, or basketball—in characteristic colors are available. Perand Products Co., Inc., Chicago, is the distributor.

Case is molded in two matching halves, with yo-yo mechanism located within



Molding phenolic housing for air-conditioner in one piece lowers production costs and improves appearance. Design incorporates molded-in louvres, necessary outlets

Phenolic Air-Conditioner Housing

MOLDING the phenolic housing of a window-type air-conditioning unit in one piece has both improved the unit's appearance and effected production economies.

Assembly labor costs for installation of the housing were greatly reduced by incorporating into the one-piece design all the necessary features of the unit including molded-in louvres for determining the direction of the cooled air; an opening for a control knob located at the side of the housing, which is molded-in with a sliding pin on a hydraulic operated cylinder; and two holes for air intake at the bottom of the unit, which are produced by having steel pass steel when the mold closes. Additional economies were achieved in the finishing operation by the special mold design which keeps the flash on the louvres to a paper thin minimum.

The one-piece molding of the housing in sturdy phenolic material also played a part in the unit's attractive styling by allowing the designer more freedom of form and contour than could be accomplished with metal.

A 36 in. ram press rated at 1272 tons produces the housing in a 5 ton mold; steel for the mold was supplied in two forgings which before trimming and hobbing, weighed 7 tons. The cavity and force were cut out of solid steel blocks. No sections were inserted.

For the molding of the unit, 28 pills, each weighing approximately 5.4 oz., are subjected to dielectric preheating; a 4-min. cure period is required.

The 9 lb. housing is for a ⅓ hp. air conditioning system, manufactured by Philco Corp., Philadelphia, Pa., and is molded by General Electric Co., Plastics Dept., Taunton, Mass. Measurements of the housing are 26 in. long, 13 in. wide, and 12 in. deep.

The unit is molded in either mottled walnut or black. For the deluxe model, the black housings are painted ivory.

Work Gloves

WORK gloves, with vinyl plastisol dots permanently set into them, are claimed by their manufacturer, Riegel Textile Corp., New York, N.Y., to greatly outwear standard 10-oz. canton flannel gloves, while retaining that material's flexibility, lightness, and comfort. The flannel serves both as the base fabric into which the dots are set and as the undotted material which comprises the back half of the glove for the three end fingers.

Restricting the plastisol dots to the front half of the glove, the thumb, and the index finger offers the greater protection to those areas that would be most subject to abrasive contact and thus more exposed to wear. At the same time, this combination of plastisol dotted flannel and regular flannel serves to obviate the limitations of cost and the wearing difficulties that a worker might possibly encounter in using an all-plastic glove.

Independent laboratory and field studies made by the company and a report by the U. S. Testing Co., in which the gloves were subjected to a series of flat abrasion tests, showed that they possess considerably greater abrasive resistance and will outlast the conventional flannel gloves of the same type by better than two-to-one, while still maintaining the working comfort and ease of use that are characteristics of the canton flannel.

Vinyl plastisol dotted work gloves are long-wearing, light, and flexible

These features, when coupled with the fact that the "Plastic-Dot" gloves cost only a little more than the regular ones, indicate an overall saving on glove costs of as much as 40 percent.

Better Cars

(*Continued from pp. 71-80*)

Particularly for models such as station wagons and special body types made in relatively small volume, formed sheet plastics offer the advantage of low tooling, finishing, and assembly costs.

POLYETHYLENE

Firestone Tire & Rubber Co. has just announced a new type storage battery which depends indirectly upon plastics for its unusual features. This battery is to be shipped to dealers dry—that is, without electrolyte—and undergoes no pre-use discharge in transit or inventory. When the battery is sold, electrolyte supplied in an accompanying polyethylene bottle is added, guaranteeing the purchaser a fresh, fully charged battery. National distribution is expected within a year.

Polyethylene is also giving modern cars a quieter, more comfortable ride, with molded and extruded leaf-spring liners which seal out dirt and grit, eliminate squeaks, and maintain alignment for the life of the spring. Polyethylene has proved to be an ideal material for this application due to its inherent self-lubricating properties, abrasion resistance, and the fact that it is unaffected by extremes of heat and cold (see MODERN PLASTICS *28*, 64, Feb. 1951).

Polyethylene spring inserts have been used successfully for several years on various makes of cars, including Studebaker and Hudson. Nylon has also been successfully used for this application.

STYRENE

Although styrene has been used to some extent in recent years for such items as dome light lenses, control knobs, and instrument panel overlays, this material is not being widely used by automotive manufacturers at the present time. One important new application just getting under way is a molded styrene automotive battery case, weighing only half as much as the conventional case and having numerous other points of superiority. The tremendous volume potential of this application is indicated by the fact that approximately 25 million automotive batteries are sold annually.

Production Battery Case

The first production application of a molded styrene battery case has been pioneered by Gould-National Batteries, Inc. The new Gould case meets the manufacturer's heat distortion test requirements of from 175° to 190° F., and also withstands temperatures as low as minus 40° F. Although the plastic is more expensive per lb. than hard rubber, this differential is offset by the more rapid molding cycle (requiring fewer sets of dies); the lighter weight, resulting in important shipping economies; and superior performance.

The inherent color possibilities of the plastic battery container also give it a strong merchandising plus over the usual black rubber case. With the battery in plain sight beneath the hood, it has become an "appearance" item that is seen frequently. In styrene, the cases can be molded in any desired color for immediate identification of the manufacturer. Although batteries are

still purchased primarily for performance, the value of color and more attractive case design cannot be disregarded in an age when even the most prosaic tools and appliances are being restyled and "streamlined" for greater sales appeal.

The new Gould styrene cases will be used at the outset for premium grade batteries carrying extended service guarantees. As the program is expanded, they may also be used later for batteries in lower price ranges.

Molded styrene battery fill plugs have been used in increasing volume for several years by a number of battery manufacturers to replace the old type hard rubber plugs. The styrene caps, besides adding a touch of identifying color, are also immune to damage by spilled battery solutions and offer increased service life. Some of them are made with a hollow, extended lower section, so shaped at the bottom that the words "add water" may be seen when the water level is low.

REINFORCED PLASTICS

The suitability in automotive applications of reinforced plastics has been demonstrated by such examples as complete sports car bodies, which are now being made on the West Coast by at least two manufacturers (see MODERN PLASTICS 29, 96, Apr. 1952). The large motor car manufacturers are fully aware of the potential advantages of reinforced plastics components, such as their high strength-weight ratio, low cost tooling, and ease of repair, but they are interested in faster fabrication techniques which may lead to lower costs and may better adapt these materials to mass-production methods.

Is it conceivable that one of the large automotive manufacturers may some day introduce a relatively low-cost sports car with reinforced plastics body to capture some of the market now going to foreign-produced cars? Although no specific information on such a car is available at present, many feel that a market for it exists. Only time can provide an answer to this question—and closemouthed Detroit isn't talking.

The possibilities of using glass fiber laminates for large components used in conjunction with existing cars are indicated by a reinforced

plastics top made to fit the XK-120 Jaguar. This durable, 21-lb. unit, incorporating a full wrap-around window of acrylic material, transforms the convertible model to a "hard top" coupe and can be put on or removed in only three minutes. The top features attractive conforming lines and is painted on the exterior surface to match the car.

A spokesman for one of the major manufacturers recently expressed the opinion that much progress had been made with reinforced plastics, and that his company should soon have at least one production part "on the road." Applications viewed as most likely include such parts as hoods, trunk lids, seat frames, glove compartments, trunk liners, scuff plates, fender skirts, and various station wagon parts. Many such components have been produced experimentally and are being evaluated.

THERMOSETS

Early in the history of American motoring, phenolics were adopted for small but vital applications which played an important part in the subsequent growth of the automobile. Charles F. Kettering, whose invention of the self starter in 1911 revolutionized motoring, has declared that without Baekeland's thermosetting phenolic resin, he could not have perfected the automotive starting, lighting, and ignition system.

Today, more than 40 years later, the broadest automotive use of molded phenolics and phenolic laminates is still in ignition parts and other electrical components. The cellulose and mineral filled phenolics, with their high dielectric strength and good dimensional stability, are particularly suitable for such applications. Other properties of the phenolics which suit them for "under the hood" applications are their dimensional stability at continuous operating temperatures as high as 225° F., and resistance to oil, gasoline, ozone, antifreeze solutions, and battery acid.

In recent years, the automotive industry has also shown considerable interest in other types of thermosetting materials, such as melamine and the newer alkyds, for similar electrical applications. For example, Plaskon alkyd molding material is now being used for the top part of an ignition coil. The material was specified for this application on the basis of its dielectric strength, resistance to electrical leakage, arc resistance, and dimensional stability under high temperatures.

Waterproofing

In the development of completely submersible equipment for military vehicles, the waterproofing problem was simplified by incorporating the ignition coil directly within the distributor housing. Conditions of use required that the equipment be capable of operating continuously for 1000 hr.—equal to some 30,000 miles of ordinary passenger car driving—without requiring maintenance. The distributor cap used in this assembly is molded of Melmac 592 compound, which has high arc resistance and is not affected by wide fluctuations of temperature and atmospheric conditions. The cap has passed rigorous Ordnance Dept. tests and is now in production as basic equipment on Willys-Overland jeeps and on trucks made for the Army by Chrysler Corp.

Heavy duty electrical parts for trailer coaches, trucks, etc., are be-

ing made of phenolic material for a variety of applications. One such unit is a three-terminal electrical connector for trailer coaches which is made of an improved impact type material. These connectors stand up under 30 amp. at 110 volt and are resistant to moisture and mechanical shock.

Another heavy duty phenolic part for automotive trailer use is a two-part coupling molded of canvas-filled material. This unit, which serves as a terminal plug and connector for four wires, plugs into a molded phenolic receptacle which mounts on the trailer, permitting the electrical air brake connection to be quickly made or broken.

The larger of the two parts, comprising the body of the unit, has a flared neck which permits a firm grip for plugging or unplugging. The interlocking, finger-and-groove design of the phenolic part provides a secure, virtually unbreakable assembly and is offset so that the two parts can be put together only one way.

Carburetor Parts

Three carburetor parts molded of Durez phenolic further demonstrate the versatility of this material for functional automotive components. The parts include an automatic choke cover, a vacuum piston, and a terminal for the piston. Smallest of the three, the terminal contains a silver-tipped brass insert and is held to a concentric tolerance of plus or minus 0.002 inches. By means of the terminal, the vacuum piston is electrically linked to the automatic transmission, adjusting the carburetor instantly to different operating conditions. The circular choke cover, molded with a large internally threaded metal insert, is serrated around the outer edge to facilitate choke adjustment.

The temperature and chemical resistance of the phenolics, along with their dimensional stability, also qualifies them for use in certain parts of the automotive cooling system. Molded phenolic water pump impellers, for example, are being used by one of the major fine car manufacturers. This six-vane impeller, approximately 4 in. in diameter, is molded of medium impact type phenolic material and incorporates a heavy duty brass bushing as an insert. Again, phe-

nolic radiator liquid strainers and water pump washers of phenolic laminate demonstrate that phenolic components are not only capable of withstanding prolonged contact with hot water, but are also unaffected by antifreeze solutions.

Phenolic laminates are also widely used for their electrical properties in fuse assemblies, switches, etc.; in distributor breaker arms their impact strength is an added value. Other uses for these laminates include thrust washers in differentials where they successfully resist the corrosive action of greases.

The somewhat limited decorative possibilities of the phenolic materials and the relatively high cost of those thermosets offering a range of bright colors have no doubt been instrumental in their limited use for decorative trim and related automotive parts. One new development which could alter this situation materially in the next few years is conductive phenolic material (MODERN PLASTICS, 29, 86, June 1952), which can be electroplated without preliminary sensitizing and without the expensive buffing and finishing required in electroplating metal die castings.

Platable Phenolics

Although plated phenolic automotive components are not as yet in actual use, many auto makers are investigating them seriously. From a General Motors spokesman comes the brief comment that they are "playing with the process in an experimental way, and find it interesting." Although the expressed opinions of automotive men regarding plated conductive phenolic parts vary widely, even the less enthusiastic representatives concede that plated phenolic parts offer definite advantages in weight reduction, lower cost, corrosion resistance.

Hood ornaments, exterior trim strips, door handles—even complete radiator grilles—are cited as possibilities for this material. It has been stated that with the proper molding set-up, possibly making use of induction type pre-heating to shorten the molding cycle, this material should yield parts that are competitive in price to plated zinc die castings, and definitely superior to them in finish and quality.

A plated phenolic part yields a higher luster than plated die-cast metal, is lighter in weight, and offers freedom from electrolytic corrosion caused by the interaction of dissimilar metals. With such advantages, engineers believe that plated phenolics have a definite edge over plated metal for semi-functional parts and even for certain functional parts, such as door handles when they are of the non-moving type, anchored at both ends.

Comparative performance tests have been conducted on plated phenolic parts and die cast parts having a high quality copper-nickel-chrome coating. Under severe conditions of exposure, plated phenolic parts showed no harmful effects, but the plated metal test pieces deteriorated badly.

ADHESIVES

Some of the most vital plastics applications in modern motor cars are never seen by the average motorist. An example is bonded brake shoes, which are now employed by two of the three major automotive manufacturers and are being evalu-

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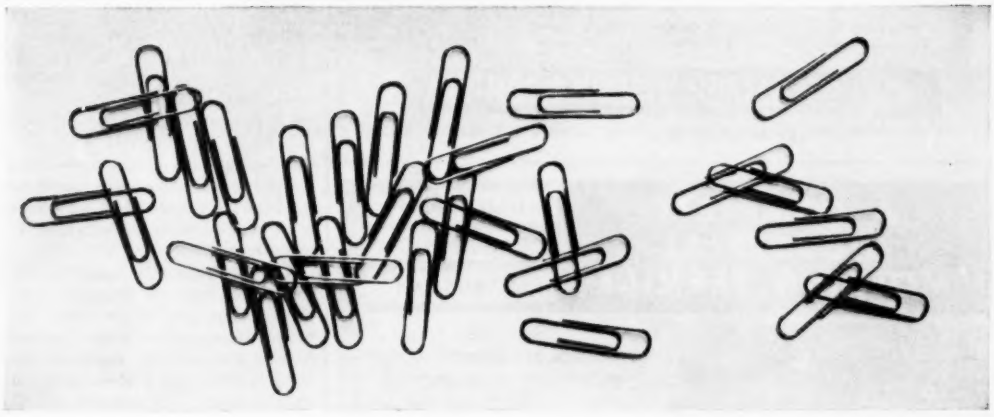

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ated by others. Cars in the Chrysler group use the Cyclebond type of linings. With no rivet heads to become exposed as the lining wears down, virtually the full thickness of the lining is available for wear, and mileage between lining replacements is approximately doubled.

A less familiar new-type application involves the use of heat resistant adhesives in automatic transmission parts. Examples include clutch disks in automatic transmission faces, which are bonded directly to steel disks, and clutch assembly bands, where the friction surface is bonded to a steel band. In a recent paper presented before the American Society of Mechanical Engineers, representatives of General Motors Research Laboratories declared:

"The adhesives have given very good service in their present applications, as is indicated by the performance of millions of brake shoes and transmission parts in the automotive industry. . . . The heat resistant, high strength thermosetting adhesives are suitable for a wide range of applications, since they can be used to join a variety of materials. Facing material on clutch disks varies from the cork and paper type to a metallic type. The adhesives have also shown good adhesion to many metals."

General Motors is conducting a continuing research program with phenolic-elastomer adhesives. In brake dynamometer tests reported before the ASME, the adhesive bond between the brake lining and shoe withstood temperatures as high as 1021° F. without failure of the bond—a test more severe than any motorist could devise. Even when the brake lining itself was worn completely through to the bonding surface after a series of high speed stops on the test equipment, the bond showed no sign of failure.

VINYLS

Of all the plastics used by the automotive industry, the vinyls appear in the greatest variety of forms. They are found as supported and unsupported sheeting for upholstery trim, door scuff pads, etc.; in molded elastomeric form in distributor cap nipples and spark plug insulating sleeves; in continuous extrusions for fender and upholstery welts; and as

plastisol dip coatings to seal automotive lamp socket assemblies (MODERN PLASTICS, *28*, 68, Feb. 1951).

Additional examples include planished plasticized clear transparent vinyl sheeting for convertible rear windows, which permit tops to be folded without interference, and woven saran monofilaments for automotive seat covers which maintain their original attractive appearance, may be wiped clean with a damp cloth, and outwear other types of upholstery.

Although the largest use of saran upholstery material is for accessory seat covers, this plastic is also supplied as regular equipment on some makes and models. Kaiser's Henry J. Corsair Deluxe models have upholstery of woven extruded plastic in combination with supported vinyl sheeting for end facings and trim. In applying the material to the Henry J. seats, Kaiser uses steam guns to shrink the fabric and obtain a better fit. The Packard convertible also utilizes woven saran upholstery as standard equipment, in combination with leather trim.

Sheet vinyl has become the favored material for capping automotive seat covers, because of its unlimited color range, ease of cleaning, resistance to staining, and other desirable characteristics. Embossed and stitchless heat-sealed quilted vinyl materials provide further decorative possibilities.

In the Ford cars, embossed vinyl coverings for door panels, available in a variety of colors harmonizing with different fabrics, provide increased beauty and utility, offering plus protection against scuffs and scrapes. Ford is among the auto manufacturers which have made use of extruded vinyl upholstery welting for more durable, attractive installations. This material, resistant to abrasion and soiling, can be tailored to the curves of the upholstery better than the usual corded types of gimp bindings.

Elastomeric Vinyl

Vinyl sheeting is being widely used, with supplementary padding, for the top surface of automotive armrests. Molded elastomeric vinyl has also been successfully used for this application, as well as in component parts of the electrical system. Vinyl distributor cap nipples offer a number of advantages over rubber nipples, including greater resistance to heat, oils, and greases, and longer service life, in addition to possessing excellent dielectric properties.

With increased emphasis on waterproof ignition systems which will not flood-out even during heavy rain storms, vinyl spark plug caps are coming into increasing use. These elbow-shaped units make possible a tight seal over the spark plug connections, shutting out moisture and dirt and insuring a good electrical connection at all times.

Insulating grommets, sleeves, and other parts used in the lighting and ignition systems are also molded or extruded from elastomeric vinyl material. Mechanical type applications include self threading tire valve caps, door bumpers, cushion gaskets for gasoline filler necks, and crankcase plugs which resist disintegration by oil.

The Chrysler line of cars has for some time used extruded elastomeric vinyl fender welting to seal the joint between body and rear fenders. In addition to its greater permanence, the vinyl welting can

be produced in any desired color to match the body paint.

Better than Rubber

Automotive men concede that there are a number of applications in which molded or extruded vinyl might do a better job than the rubber now being used for certain parts. According to some industry sources, the average auto body now utilizes about 3 lb. of vinyl material, and possible additional applications might swell the total to around 15 lb. per car.

The price differential between vinyl and rubber is a major obstacle yet to be overcome in realizing some of these potential applications. Clutch, brake, and accelerator pads, for example, if molded of vinyl, could be made in colors harmonizing with car interiors. Vinyl windshield garnish molding welts and glass seals for rear windows are other locations where vinyl's inherent color and heat sealing characteristics might be put to good advantage. If desired, such parts might even be extruded in two colors—one matching the car, the other of lower cost black material for sections not seen in the final assembly.

If this application should go to vinyl some time in the future, the volume of material involved would be considerable. In one 1952 car, for example, the combined weight of the rubber gaskets for the windshield and rear window is approximately nine pounds. One problem vinyl weatherstripping would overcome is the ozone checking and cracking experienced with rubber.

Safety Glass

The vinyl butyral safety glass interlayer, standard throughout the auto industry for a number of years, has undergone an important new development during the past year or so. Buick, in 1951, was first to offer its E-Z-Eye glare reducing glass, which also cuts down on the amount of radiant heat entering the car. The desired effect is obtained, in part, by graduated tinting of the plastic interlayer, which is then used in the customary manner to bond the glass panels together.

The Future?

Millions of passenger cars, trucks, and busses are being produced annually. The established record of

plastics in the automotive field is broadly outlined above. A quotation from a representative of a large manufacturer of motor cars, taken from "Plastics Futures," MODERN PLASTICS, March 1952, succinctly summarizes the part which the plastics industry can be expected to play in the production of tomorrow's automobiles: "Expect the impossible of plastics."

Acknowledgements

The editors extend their best thanks to the automotive manufacturers who cooperated in the preparation of this article. Also gratefully acknowledged is the invaluable assistance of the following members of the plastics industry and suppliers of automotive equipment:

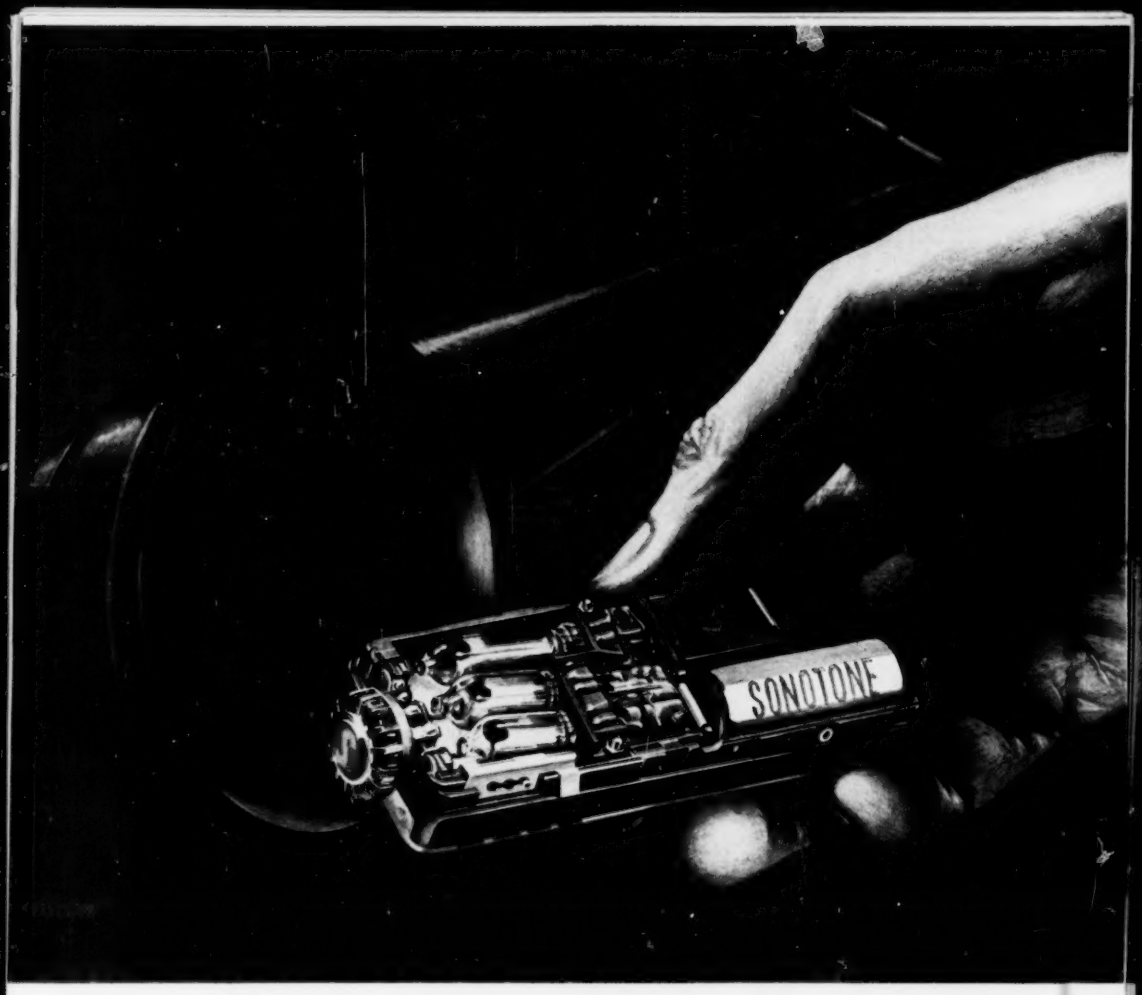
American Cyanamid Co.; Bakelite Co.; Theodore Bargman, Detroit, Mich.; L. E. Carpenter & Co., Wharton, N.J.; Casco Products Corp., Bridgeport, Conn.; Chicago Molded Products Corp., Chicago, Ill.; Cruver Mfg. Co., Chicago, Ill.; Detroit Macoid Corp., Detroit, Mich.; E. I. du Pont de Nemours & Co.; Erie Resistor Corp., Erie, Pa.; Filter Devices, Inc., Philadelphia, Pa.; General American Transportation Co., Chicago, Ill.; Glasspar Co., Costa Mesa, Calif.; Great Lakes Plastics, Plymouth, Mich.; Hoosier Cardinal Corp., Evansville, Ind.; Ideal Toy Corp., Hollis, L.I., N.Y.; Industrial Plastics Co., Cicero, Ill.; Jason Corp., Hoboken, N.J.; Kent Plastics Corp., Evansville, Ind.; Mallory Electric Corp., Detroit, Mich.; Michigan Molded Plastics, Inc., Dexter, Mich.; Molded Products Co., Detroit, Mich.; Samuel Moore & Co., Mantua, Ohio; Owens-Corning Fiberglas Corp.; Plaskon Div., Libbey-Owens-Ford Glass Co.; Plastic Research Products, Urbana, Ohio; Redmond Co., Inc., Owosso, Mich.; Rohm & Haas Co.; Sheller Mfg. Co., Portland, Ind.; Sinko Mfg. and Tool Co., Chicago, Ill.; Spring Perch Co., Inc., Lackawanna, N.Y.; Stimsonite Plant, Chicago, Ill.; Synthane Corp., Oaks, Pa.; Tennessee Eastman Co.; Ternstedt Div., General Motors, Detroit, Mich.; The Electric Auto-Lite Co., Toledo, Ohio; Toledo Plastics Co., Toledo, Ohio; U. S. Rubber Co.; Vac-Art, Inc., Bay City, Mich.; Warner Electric Brake Mfg. Co., Beloit, Wis.; Woodall Industries, Inc., Detroit, Mich.—END

Extrusion

(*Continued from pp.* 99-108)

supply of salt in the bath, since the gas flame will burn through an empty container; 3) do not introduce wet parts into the salt bath; 4) do not take this salt internally under any circumstances; 5) do not introduce into the bath any material which gives off acid when decomposed, for this would damage the parts being cleaned; 6) do not introduce into the bath any chrome-plated parts, since the bath will damage or remove the plating; and 7) lower the basket into the salt bath and water bath slowly.

In designing the salt bath, care should be taken to protect operators from being burned by splashing of molten salt. The salt bath is sometimes made with a cover which automatically closes when the basket is swung away from it. The basket and baths should be made long enough to accommodate a little more than half of the longest screw, and wide and deep enough to handle any large crossheads or other parts.—END



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Plasticizer

(*Continued from pp.* 111-118)

stearate, tetradecyl benzoate (31), and phenyl oleate (76). A combination of cyclic and ether groups as in tetrahydrofurfuryl oleate is quite effective (101). Long chain stearates or dodecyl oleate have been used to give high temperature flow resistance to insulation (28). Chlorinated methyl stearates are useful (87). Three to six chlorine atoms are generally preferred. Increasing chlorine content increases compatibility and dielectric loss (57).

Miscellaneous Cyclic Esters—A tremendous number of cyclic plasticizer structures have been prepared. A few examples will illustrate. Dioctyl tetrahydrophthalate (the acid is derived from maleic anhydride and butadiene) is better at low temperature than dioctyl phthalate but less compatible. Dioctyl hexahydrophthalate has been introduced. Esters of dimethyl tetrahydrophthalic acid (42) and endomethylene tetrahydrophthalic acid (67) have been patented. The dioctyl ester of $p\text{-}C_6H_4(OCH_2COOH)_2$ has low volatility (20). The dioctyl esters of $O(C_6H_4COOH)_2$ and similar acids are of interest (35). Di(dimethylbenzyl) carbonate is available. Chlorinated phthalic acid esters have been recommended (52,98).

Polymeric Plasticizers—The so-called "resinous plasticizers" are polyesters in the 1000-7000 molecular weight range. About 8 or 10 of these are on the market. They are derived from a glycol, a dibasic acid, and sometimes a monobasic acid to control molecular weight. The higher molecular weight types are unusually low in volatility and outstanding for resistance to migration and extraction (39,91,102). They are superior for flame resistance to ordinary plasticizers except the phosphates. Processibility and efficiency suffer and more recently the trend has been to the 1000-2500 molecular weight range to eliminate these drawbacks while retaining the greater part of the desirable properties. Paraplex G-25 (sebacic acid-propylene glycol polyester of 7000 molecular weight) acts like a plasticizer of 500 molecular weight. This indicates a functioning at more than one position in the molecule (83). The polyester from thiodibutyric acid

and butylene glycol (Plastomoll TB) was used in Germany during the war for gasoline resistance (37). The migration resistance of polyesters is claimed to be improved even further by modification with a polyfunctional isocyanate (13). The Buna N type rubbers of either high or low acrylonitrile content achieve much the same results as the polyesters (81,107). A patent covers grease-like olefin-carbon monoxide copolymers as low volatility, migration-resistant plasticizers (26). Low molecular weight (400-700 MW) polymers of styrene, allyl acetate, butyl acrylate, etc. are compatible (6). Vinyl resin compositions plasticized by mixture of polymethyl methacrylate and a conventional plasticizer are patented (65,75).

Amides — Amides are effective plasticizers if properly stabilized. The amide group is generally completely substituted to achieve the best flexibility. The dioctanoate of N,N-di(2-hydroxyethyl) octanoamide is currently marketed. Fatty derivatives such as N,N-dibutyl-stearamide are compatible. Methyl-benzamide imparts good cold flex to sheeting (28).

Hydrocarbons — Hydrocarbons are useful as low cost extenders and for improving electrical properties. Aromatic hydrocarbons have strong swelling power but poor compatibility, heat stability, low temperature flexibility (37). Benzyl naphthalene was best known in war-time Germany, being used in electrical insulation (28). Similiarly, alkyl substituted phenanthrenes may be used (106). Highly condensed aromatic hydrocarbons of dark color are available as petroleum refining by-products. Partially hydrogenated terphenyl and low molecular weight poly(alpha - methyl - styrene) are light-colored, have electrical uses.

Miscellaneous Plasticizers — Aconitic and tricarballylic acid esters are good. The nitrile group is very effective. Thus, tolylstearonitrile and biphenylstearonitrile are compatible, have low volatility and good light and heat resistance (14). Ketones such as polyalkyl benzophenones (58), phenyl octyl ketone, and alkyl chloronaphthyl ketones (48) have been suggested. Aromatic ethers can be used. The best found by the Germans during the war were discresyl diglycol ether, dixyleneglycol ether, 2,3-dioxy-dioxenediglycol ether, and 2-phenoxymethyl tetralin. The latter or its 1-analog or their derivatives are claimed (43). Di-*t*-amyl-phenyl *p*-chlorobenzyl ether and di(alpha-methylbenzyl) ether have also been mentioned (104). The latter is also a stabilizing plasticizer for polyvinylidene chloride (15). Di(dimethylbenzyl) ether is currently being offered. The thioether, dimethylthianthrene, is an extender (37). Higher chlorinated aliphatic hydrocarbons, when of sufficient chlorine content for good volatility, are too viscous and have poor low temperature flexibility. Lower chlorinated hydrocarbons are too volatile and incompatible and more chlorine renders them too non-polar (37). Chlorinated hydrocarbons can now be reasonably well stabilized to heat and light by dibasic lead phosphite. *o*-Nitrobiphenyl requires a high working temperature and a stabilizer such as lead carbonate. Aromatic alcohols gelatinize polyvinyl chloride but none are satisfactory because of stiffness and volatility; dicyclohexyl methyl carbinol comes closest (37).

Formulating Techniques

Calendering—The plasticizer influences the mixing time prior to calendering and the calendering speed and temperature. An extensive study (9) of Banbury mixing rated the fusion time with various plasticizers: very short—cresyl diphenyl phosphate, octyl diphenyl phosphate, butyl benzyl phthalate; short—tricresyl phosphate; moderate—dioctyl phthalate, hydrogenated terphenyl; long—dioctyl adipate, tetrahydrofurfuryl oleate, methyl acetyl ricinoleate, tetraethylene glycol di(2-ethylhexoate); very long—Paraplex G-50. Except for G-50, lower plasticizer content gives shorter fusion time. The shorter the fusion time, the faster an average uniform temperature is reached and the higher the hp. requirement. A similar study (72) rated flux time (time required for dry resin-plasticizer mixture to form a continuous band on mill rolls) at 310° F. for various plasticizers with polyvinyl chloride: various Cellosolve and Carbitol phthalates 15 sec.; dioctyl phthalate, di-iso-octyl phthalate, tricresyl phosphate, tri-butyl Cellosolve phosphate 20 sec.; methyl-Cellosolve oleate, butyl Cellosolve stearate, various adipates 30 sec.

Plastisols—The proper balance of plasticizer properties is more critical than ever in plastisols. The plasticizer should have little solvency (just enough to stabilize the dispersion but not enough to cause excessive viscosity) for the resin at room temperature, but should flux rapidly at low temperature (24). A flat plasticizer viscosity-temperature curve is desirable (86). Generally the lowest viscosity plasticizers give the lowest viscosity plastisols. Tri-cresyl phosphate and dioctyl phthalate work well, but dibutyl phthalate is too active (16, 17, 24, 69, 86). Trioctyl phosphate (18, 100), tetrahydrofurfuryl oleate (100), dioctyl sebacate, and butyl Cellosolve adipate give low viscosity plastisols. The German Mesamoll I (28, 86) and o-nitrodiphenyl ether (88) also work well. Small amounts of additives such as certain amines (60) and polyglycol esters reduce viscosity. A plastigel is a new version of the plastisol containing a little aluminum soap or bentonite to give firmness for casting without pressure. A plastifoam is another new version in foam form, created by methods well known for rubber.

Organosols—Principles of formulation are very similar to those for plastisols and naturally the added "solvent" also plays an important part (70). The plasticizer acts as a dispersant along with the solvating portion of the solvent as opposed to the diluent or non-solvating portion. Dioctyl phthalate is well suited for oganosols. Methyl Cellosolve acetyl ricinoleate can be substituted directly for dioctyl phthalate. Dibutyl phthalate, tricresyl phosphate, butyl phthalyl butyl glycolate, and trioctyl phosphate require a smaller proportion of dispersant. Less active plasticizers such as tetraglycol di(2-ethylhexoate) require a greater proportion of dispersant.

Latices and hydrosols—Dry resin may be dispersed in water to form a hydrosol. One method uses a Werner-Pfleiderer mixer in the presence of a plasticizer such as butyl Cellosolve phthalate or dibutyl sebacate (19). More conveniently a vinyl latex is blended with a separately prepared plasticizer emulsion (87a). Pre-plasticized vinyl latices are also available. Vinyl-Buna N latex blends are also readily prepared.

Pigments and Colors—Color problems in vinyl resins have been

reviewed (22). Oil soluble colors do not bleed from unplasticized films, but cannot be used in plasticized films because of bleeding (23). Bleeding varies due to different swelling of the color by different plasticizers (71). The amount of crocking of a color varies with the plasticizer used. Plasticizer purity, particularly acidity, influences color (29). Cellosolve phthalates and castor oil derivatives are susceptible to degradation involving interaction with certain oxidizing colors.

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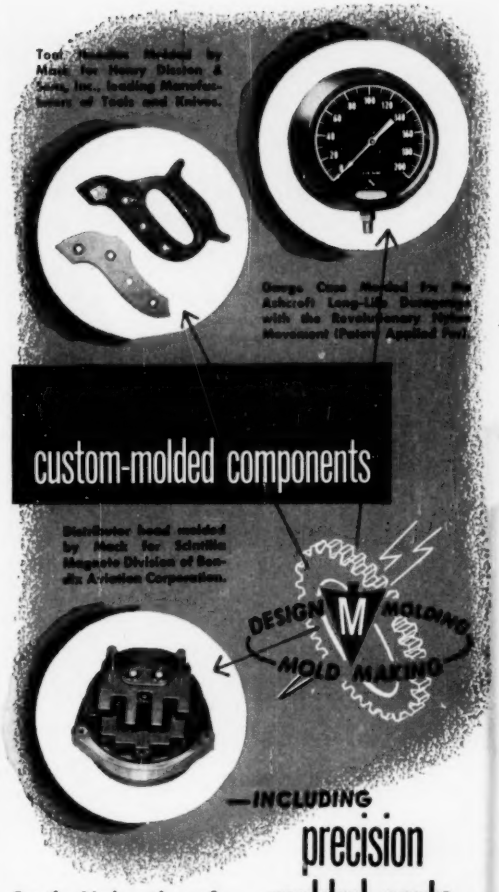

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Rigid Sheets

(*Continued from pp.* 84-7)

use its own 0.050-in. white translucent extruded Tenite II in the manufacture of its products. The sheets are silk-screened first with special inks in flat form, and then drawn into units of huge size, up to 60 in. long.

A sheet butyrate application of unusual interest is a translucent window shade for the Greyhound Silversides bus, fabricated by Paramount Plastics Co., Chicago, Ill., from a 0.060-in. white translucent sheet extruded by Midwest Plastic Products Co., Chicago, Ill. The product is made for Plastics Specialties, Inc., Palatine, Ill., and replaces a compression molded sheet weighing 3 lb. and made on expensive steel molds. The new shades are heat formed on wooden dies, weigh only 2 lb., cost about 25% less than the molded units. This represents a saving of about $35 per bus.

Extruded ethyl cellulose sheet is used in some formed commercial applications, but is more generally used flat, since it prints with remarkable accuracy. The newest extruded rigid sheet thermoplastic, styrene, has so far not been given big development work as far as forming is concerned.

Vinyl

Rigid vinyl chloride-acetate copolymer, Vinylite, in translucent and solid color, is one of the most generally recognized formed thermoplastics, and many of the techniques now used on other rigid sheet thermoplastics were developed on this material.

A big user of this material in display work is W. L. Stensgaard and Assoc., Inc., Chicago, Ill. A recent Stensgaard specialty is a series of Zodiac plaques, formed from clear Vinylite and decorated on both front and back to obtain the desired effects. The molds for the frames of these plaques were made of simple Masonite textured Leatherwood hardboard. The units were formed by air pressure over male forms.

Vinylite doll faces are by now standard, and are vacuum formed or blow formed by several companies. This material offers some advantage in ease of decoration.

A relatively new but probably to-be-important application of rigid Vinylite sheet is in the manufacture of printing electrotype molds, where the dimensional stability and impact resistance is most useful. Type is not damaged when the plastic "shells" are removed. The economies are great.

While there is big business yet to come from the formed thin thermoplastic sheets in the accepted fields of signs and displays, packaging, and decorative units, there are also vast new fields to conquer. New heating and forming methods, improved thermoplastic sheets, new knowledge of printing, will help to conquer these fields. In the thicker materials, almost nothing has yet been done, in housings and other industrial components. In tote boxes and other material handling units, in the television and radio field, and even in refrigeration, there are distinct possibilities.

There is bound to be broadened application of vacuum formed thermoplastic sheets.—END

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Next month: The third article of this series will cover the forming of acrylic sheets.

Elastomers

(*Continued from pp. 120-24*)

silience can be achieved by the use of different resins. However, in a practical sense these differences are small and of questionable importance, and may even be attributable to minor compounding or processing variations.

The relation between the resilience minima and brittleness has been discussed by Friedlander (6) and is supported by the data presented here. It will be noted that in Fig. 4 an apparently linear relationship exists between the minimum resilience temperature and DOP plasticizer concentration. A similar relationship is reported by Clash and Berg (7) between brittle temperature and plasticizer concentration. Since the minimum resilience temperature and brittle temperature are mutually correlated with plasticizer concentrations, an inter-relation between resilience minima and brittleness must exist. Similar reasoning leads to a parallel conclusion between resilience minima and stiffness. Thus, a low minimum resilience temperature reflects a low embrittlement temperature and also reflects a low room temperature stiffness.

Table V—Temperature-Resilience Characteristics of Various Resins Plasticized with 35% DOP

	Rebound			
	Vinyl Chloride-Vinyl Acetate Copolymer	Polyvinyl Chloride		
Temperature		#1	#2	#3
°C.	%	%	%	%
100	60	58	60	58
	63	62	63	60
120	53	58	57	56
	54	55	57	55
135	48	52	52	47
	46	50	50	47
150	40	42	39	38
	39	41	39	39
170	24	27	23	19
	22	22	24	21

Analysis of Variance

Source of variation	Degrees of freedom	Sums of squares	Mean squares	F	Probability
Temperature	3	7,135	1,784	649	0.001
Compound	4	49	16.3	5.94	.01-.001
Interaction	12	39	3.25	1.33	
Residual	20	49	2.45		
Pooled Residual	32	88	2.75		
Total	39	7,272			

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

A Different Foam

VARIOUS formulations for foaming rubber and vinyl have been announced in the last two or three years, but according to its producer and processors who are experimenting with it, Interchemical Corp.'s Foam Plastisol has properties and possibilities quite different from most of the other thermoplastic foams.

As is well known, rubber foam, although it has had wide acceptance, has certain handicaps such as oxidation, odor, and susceptibility to oils and greases; also, it has to be molded with a certain amount of pressure even on a continuous basis. Expanded vinyls have not yet reached real large scale production, and as a result, are not yet thoroughly tested.

Three categories of expanded vinyls have been developed. The first type is mechanically expanded with a gas such as nitrogen or carbon dioxide in a pressure vessel. The second is chemically expanded under heat and pressure with long cooling and heating cycles.

A third type is chemically blown under atmospheric pressure with a single phase heat treatment, and can thus be run continuously as through an oven on an endless belt. This opens up for the first time the field of continuous expanded sheeting, self-supported or cast onto fabric. Interchemical Corp., 67 W. 44 St., New York, N. Y., is a major producer of this type of foam.

Generally speaking, Interchemical's expanded Foam Plastisol could replace foam or sponge rubber where the vinyl could do a job that can't be done with rubber. The cost would be very little higher than rubber because long cycles and molds would not have to be used. Under certain conditions, Foam Plastisol can be sprayed, cast, or coated either with a knife coater or a reverse roll coater. At present, thicknesses above ½ in. would be obtainable only by lamination, but it is believed this is only a temporary limitation.

New formulations of this material are wash resistant, non-migratory, and practically odorless. Dry cleaning resistance is good. The material can be expanded to densities as low as 20 lb. per cu. foot.

Laboratory experiments with new formulations indicate that densities in the neighborhood of 12 lb. per cu. ft. are a distinct possibility. An example of the unusual things that can be done with this material was shown in a piece of upholstery at the Philadelphia Plastics Show which was formed from foamed sheet with a brilliantly colored flock surface.

The big idea, of course, is that neither pressure nor molds are required to handle this material. The wet compound is subjected to 350° F. of circulating hot air for from 5 to 15 min., depending on thickness and density. It can be produced on a continuous basis, and 2 lb. of the wet material expanded three to four fold to a density of 20 lb. per cu. ft. will yield approximately 1 sq. yd. of ⅛ in. foamed sheeting. The material can be foamed on most surfaces that will withstand required temperatures without changing character. Expanded materials may be laminated, embossed, heat sealed, printed, and bonded to most surfaces with a special adhesive.

Government Contracts

IT is encouraging to hear about a sizeable Armed Forces contract that has been handled without the frequently unhappy results that follow development work when some contractor other than the developer attempts to "move in" with a cut price.

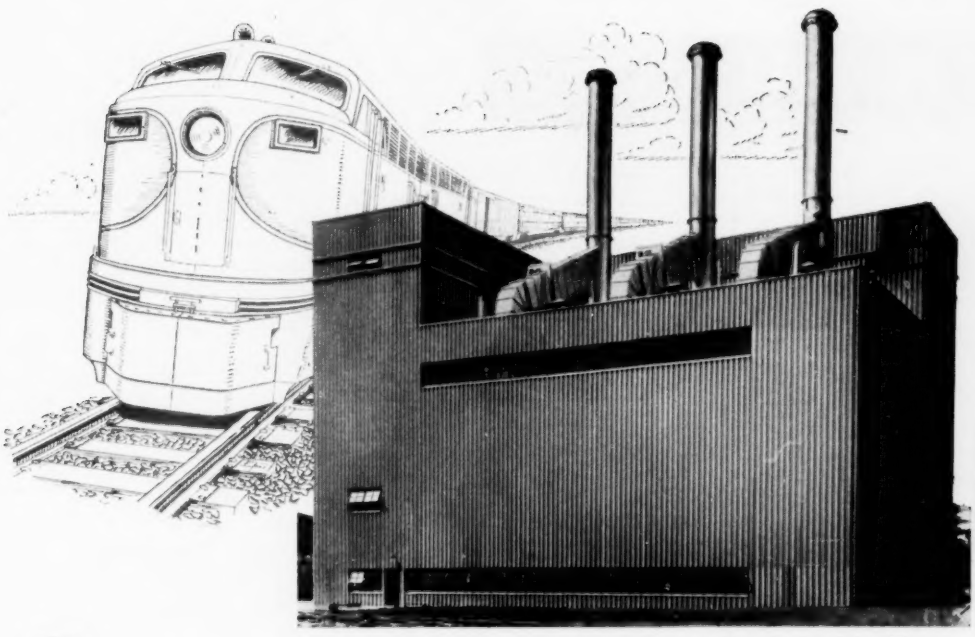
Many people claim that such shenanigans have been one of the reasons for slowness in the Armed Services program. Delays in plastics products have frequently been encountered because Government officials have been forced by Congressional edict to cut to the very bone and accept development contracts and finished goods contracts at a much lower price than would insure delivery of a top grade product. This trend has been especially noticeable in the glass reinforced plastic military program. There have been many delays and unsatisfactory projects simply because low bidders have not been able to produce satisfactory products at the low price bid in and the contract has had to be withdrawn and relet to another contractor. Some examples are bleach containers, ammunition shipping containers, and some parts of the boat program.

Some plastics fabricators have stated that they will do no development work at their own expense for military applications. Their stated reason is that, if they do develop a satisfactory product, someone else will probably get the final production orders. This reluctance on the part of many competent fabricators to work on military applications has undoubtedly impeded the defense program.

A potent example in the matter of contracts for finished goods comes to us in a letter from W. F. Reibold, vice president of Waterbury Companies, Inc., who took serious objection to a recent paragraph in the MODERN PLASTICS Bulletin in which it was stated that procurement officers for the Government were having difficulty in obtaining the services of good molders to produce melamine dishware. Said Mr. Reibold:

"We would be only too happy to supply plastic tableware to the Quartermaster and feel certain that a good many other molders would do the same providing they were permitted to make a small profit or even have returned to them their actual factory cost.

"We and a number of other large molders have quoted on the tableware invitations a number of times and in studying the abstract of the bids, practically in every instance the items were purchased according to our accounting, far below our actual factory cost. In one specific instance, the material in the item amounted to 26¢ per unit and the Quartermaster purchased the item



Steam generating plant of Fairbanks, Morse & Co., Beloit, Wisconsin.

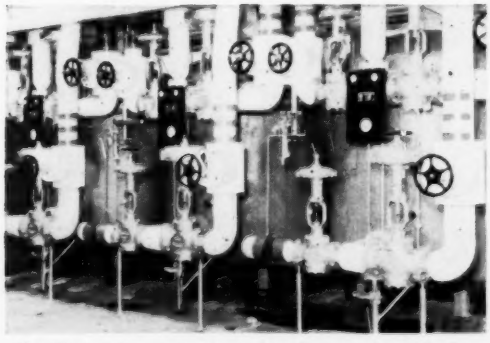
STEAM POWER TO BUILD DIESEL POWER

World famous diesel locomotive manufacturers, Fairbanks, Morse & Co., employed Stone & Webster Engineering Corporation to design and construct a new steam generating plant.

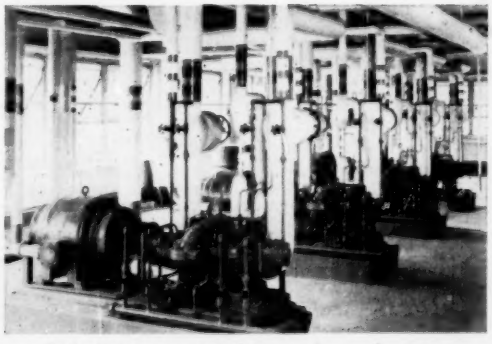
Designed for rapid changes in steam demand, up to the heaviest processing loads, the new plant yields substantial fuel savings of $600 to $650 per day, and provides complete continuity of service.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.



Completeness of instrumentation throughout is indicated by this view of the water treatment system.



Boiler feed pumps and facilities are of unusual capacity because of the heavy steam demand.

PLASTISCOPE

at approximately 30¢ each. We or no company who know what they are doing can ever hope to break even with a differential of 4¢ to cover molding, overhead, etc."

Perhaps a turn for the better in this situation is indicated by the Marine Corps procurement policy in obtaining body armor. The Marine Corps first drew up rigid specifications for the best product obtainable. Only those manufacturers who submit samples which equal the best material available are put on the qualified bidders' list. To date, only Continental-Diamond Fibre Co. is on this list. This company has, therefore, obtained a negotiated contract to supply substantial quantities of body armor to the Marine Corps.

Continental-Diamond Fibre Co. had spent its own money developing resin bonded glass plates for body armor which appear to be better than those available from other sources. The company has found that spending its own money in developing military applications can be profitable. The military has gained by Continental-Diamond Fibre Co.'s investment of development money because a high-quality product has resulted which can be obtained in large volumes.

Certificates of Necessity

CERTIFICATES of Necessity for accelerated tax amortization for chemicals and plastics are rolling out faster than ever as the Government makes plans for a program that will take care of all emergency and most of the civilian needs in 1955. In an adjoining column is printed those that have been granted since the list published here one month ago. Particularly significant for plastics are the following:

Rohm & Haas certificates amount to a total of around $15 million and represent an expansion for acrylic sheet making facilities at both Bristol, Pa., and Knoxville, Tenn.; additional methyl methacrylate monomer and polymer facilities at Bristol; new plants at Deer Park, Texas, for the production of ethyl and methyl acrylate and hydrogen cyanide. The latter is used in the production of acrylates. It has been reported that a larger sheet than any now in production is to be manufactured for airplanes at the Knoxville plant. The company's sheeting capacity had already been enlarged before these certificates were granted so that the combined total would be doubled that of the old war time capacity.

Texas Eastman, affiliated with Tennessee Eastman, received a certificate for the production of "polyethylene plastics material" at Harrison, Tex. No comment concerning this certificate has been forthcoming from the company.

This development has been one of the best kept secrets in the chemical industry when one considers all the possibilities of leakage that were involved. The understanding is that plans call for the manufacture of

Certificates of Necessity

Company	*Product*	*Amount Certified*	*% Allowed*
U. S. Steel Co. Clairton, Pa.	Coke and coal chemicals	$12,570,000	45
The American Steel & Wire Co. of N.J. Cleveland, Ohio	Coke and coal chemicals	1,450,000	45
The American Steel & Wire Co. Duluth, Minn.	Coke and coal chemicals	7,280,000	50
Gulf Oil Corp. Deer Park to Port Arthur, Tex.	Ethylene	585,800	60
Surprenant Mfg. Co. Clinton, Mass.	Wire and cable	319,961	65
Celanese Corp. of America Belvidere, N.J.	Extruded plastic film for military use	1,144,000	60
Newark, N.J.	Extruded plastic sheets for military end items	403,000	60
National Automotive Fibres, Inc. Little Falls, N.Y.	Parachutes	46,740	50
Little Falls, N.Y.	Parachutes	9,929	50
The Okonite-Callender Cable Co., Inc. Paterson, N.J.	Shipboard cable for U.S. Navy	83,217	65
Allied Chemical & Dye Corp. Hopewell, Va.	Methanol and formaldehyde	11,900,000	45
Semet-Salvay Div., Ironton, Ohio	Coke	1,325,000	50
Tennessee Products & Chemical Corp. Chattanooga, Tenn.	BHC Lindane and trichlorabenzine	217,132	45
Commercial Solvents Corp. Peoria, Ill.	Formaldehyde	385,000	55
General Cable Corp. St. Louis, Mo.	Field wire	66,050	50
G. A. Masites Co. Fort Worth, Tex.	Rubber and plastic linings for tanks	48,169	50
Union Carbide & Carbon Corp. Texas City, Tex.	Oxygen and methanol	9,040,360	50
Shell Chemical Corp. Houston, Tex.	Epon resins	4,063,000	50
		472,900	45
		226,100	15
Union Oil Co. of Calif. Wilmington, Calif.	Benzene and toluene	2,950,000	45
		6,663,000	65
		2,387,000	90
The M. W. Kellogg Co. Jersey City, N.J.	Navy ordnance	905,910	65
Shaw Insulator Co. Essex County, N.J.	Ordnance	6,820	65
Lee Plastics Co., Inc. Philadelphia, Pa.	Aircraft parts	14,828	80
U. S. Plywood Corp. Cattaraugus, N.Y.	Metal-clad plywood for the Armed Services	1,269,628	65
Mess Iron Co. Trafford, Ala.	Coke and coke chemicals	227,638	85
Wyandotte Chemicals Corp. Wyandotte, Mich.	Ethylene oxide	6,200,000	50
Texas Eastman Co. Harrison, Tex.	Polyethylene plastics material	7,000,000	60
Rohm & Haas Co. Bristol, Pa.	Methyl methacrylate for Plexiglas sheets	1,263,449	80
Knoxville, Tenn.	Plexiglas sheets for the Armed Services	604,875	80
Knoxville, Tenn.	Plexiglas sheets for the Armed Services	50,500	80
Knoxville, Tenn.	Plexiglas sheets for the Armed Services	105,250	80
Deer Park, Tex.	Ethyl and methyl acrylates for Plexiglas sheets	7,465,734	40
Deer Park, Tex.	Methyl methacrylate for Plexiglas sheets	4,791,703	80
Deer Park, Tex.	Hydrogen cyanide for Plexiglas sheets	1,113,576	80
Jefferson Chemical Co., Inc. Port Neches, Tex.	Ethylene oxide	18,700,000	50
American Petrochemical Corp. Lake Charles, La.	Vinyl and ethyl chloride	26,640,000	50

THE FJ-2 FURY

This North American Aviation, Inc. new sweptwing jet fighter is a speedy, highly maneuverable plane designed especially for Navy carrier operations. The optical properties of its Swedlow-made transparent enclosure contribute to the efficiency with which this versatile fighting machine can perform in action.

VISIBILITY by Swedlow

The Swedlow facilities bring to the production lines of American industry 10 years of specialized experience in precision engineering and production of acrylic and laminated fiberglas parts.

Swedlow PLASTICS CO.

LOS ANGELES, CALIFORNIA • YOUNGSTOWN, OHIO

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both low and high molecular weight polyethylene. Another certificate is expected to come along later, but the one mentioned here is supposed to be ticketed for high molecular weight polyethylene. It's dangerous to guess how large a plant is going to be built on the evidence of a TA certificate but experienced observers in the polyethylene industry estimate that the proposed plant may have a capacity of from 1½ to 2 million lb. a month and could be ready for business by the end of 1953 or early 1954.

The M. W. Kellogg certificate is for a big, new Kel-F plant. A great part of the new production which will be ready soon is for an undisclosed ordnance item but it is expected that the new plant will make possible a substantial reduction in the price of Kel-F and make available a considerably larger quantity for ever-increasing civilian applications when the plant gets into complete operation some time late this year.

The Shell Chemical certificate for a plant in Houston, Texas, to produce Epon (epoxy resin) represents a big step forward in the development of this comparatively new, utilitarian resin which has demonstrated remarkable properties for use in coatings, adhesives, and other purposes.

The Celanese certificate represents an expansion in both their Belvidere and Newark, N. J. plants for cast and extruded sheet and film, both of which are being used in ever increasing quantities by the Armed Forces. The new facilities are just about ready for production.

The American Petro-Chemical Corp. certificate for a $26 million plant to produce ethyl and vinyl chloride is the first project of the Cities Service-Firestone combination. No information has been made available on how much of either product will be produced but everyone knows that $26 million will build a whopping big plant. However, company spokesmen point out that this cost includes land, clearing fields, draining swamp, administration building, power house, and all the essentials required in building from the ground up, so actual capacity cannot be judged by the quantity of money involved. It can also be guessed that a large production of ethyl chloride is involved since the market for tetra-ethyl-lead, which requires ethyl chloride, is constantly increasing.

The accelerated tax write-off program is provided for in the Revenue Act of 1950. Prior to passage of that Act, the period permitted for depreciation of new facilities by the Bureau of Internal Revenue varied up to 25 years, depending on the normal life usefulness of the facility. In the Chemical Industry, plants generally tried to amortize in 10 or 12 years due to the many hazards of obsolescence. Under the statute, this period may be shortened to five years for such portion of the new investment as DPA may determine.

New Decyl Plasticizers

TWO new all-decyl plasticizers called Cabflex DDA (di-decyl adipate) and Cabflex DDP (di-decyl phthalate) have been introduced by Godfrey L. Cabot, Inc., 77 Franklin St., Boston, Mass. They are all-purpose plasticizers. Prices have not been announced but we have been assured that they will be competitive. They are claimed to be different from the decyl plasticizers now on the market in that the Cabot plasticizers are 100% decyl—the others are said to be about half and half decyl and octyl. Furthermore, the supply of decyl alcohol for the Cabot plasticizers is unlimited since it is synthetically produced from petroleum. Previous supplies have been scarce because only limited quantities of cocanut oil from which it was produced were available.

The decyl plasticizers received favorable attention when first produced because they offer lower volatility and more permanence in vinyl compounds than is obtainable from octyl phthalates, yet they retain similar low temperature properties. Di-iso-octyl adipate, for example, has a brittle point of around -55 to -60° F., and di-decyl-adipate of from -45 to -50° F. DIOP has a brittle point of from -30 to -35° F. and di-decyl-phthalate of from -25 to -30° F. Because they cost a few cents more per lb., the adipates are generally used for blending to give low temperature flexibility to vinyls, but the di-decyl-phthalate is often used as a complete plasticizer.

Another new Cabot plasticizer is Cabflex di-capryl phthalate which sells at 2¢ a lb. less than DOP. It is very similar to octyl phthalates, but Cabot has overcome the old handicap of odor and color formerly quite prevalent in capryls and believe that capryls may assume a far more important position in the industry. Capryl alcohol has become available in increasing quantities recently. It is produced from capryl oil which is left over in the production of sebacic acid from castor oil; sebacic acid production has been mounting due to special plasticizer and lubricating needs by the Armed Forces.

These new plasticizers are in addition to those plasticizers with which Cabot entered the field in 1949. They are DIOP, DIO adipate, and a specialty plasticizer, di-iso-butyl adipate, which is used as a low temperature plasticizer for rubber; for saran; and as a non-toxic plasticizer for vinyl chloride. A primary plasticizer, but with a little higher volatility than the octyls, it costs 1¢ a lb. more than DIO adipate.

Errata

OUR face is red from other causes than sunburn due to slips of the pen in two recent news items concerning vinyl film and coated fabric appearing in this column last month and the month before. Maybe the heat "took" us. In the July issue under an item headed "Coated Fabric Shipments Rise" it was inadvertently stated that "film and sheeting is the only branch of the plastics industry coming to our attention which has reported more shipments in 1952 than in 1951." Tsk! Tsk! We got tangled on that one. What we meant of course was that coated fabric was the item with the better 1952 record. Since that time we have learned that shipments of vinyl resin for wire coating are also reported to be running ahead of 1951.

The other "slip" made two months ago was a complicated sentence that some readers might have interpreted as meaning that nitrate or pyroxylin coated cloth was sometimes calendered. Far be it from us to suggest

How to get the performance you want from your vinyl products:

use OPALON vinyl resin

Whether or not your vinyl product measures up to your specifications depends largely on the vinyl resin you use.

Whatever your requirements, you'll find Monsanto's OPALON 300 resin and OPALON compounds available with the combination of properties *best suited* for your product. For example:

- For draperies, Monsanto's OPALON gives you exceptional color depth and clarity, along with better color uniformity.
- For garden hose, OPALON shows better resistance to weathering, ageing and wear.
- For rainwear, OPALON has low-temperature flexibility combined with toughness and strength.

For extrusion—save up to 8¢ per lb.

In all extruded applications—you can save *up to 8¢ per lb.* in raw material costs by dry blending OPALON 300. Extruders of hose particularly have discovered how dry blending cuts costs and frequently increases extrusion rates as much as 25%. Other production steps such as milling, cooling, and granulating or dicing are eliminated, reducing labor cost and expensive equipment.

Write for latest information on dry blending in the new Monsanto booklet, "Dry Blending OPALON 300 in the Manufacture of Extruded Products." Fill out and mail the coupon—now.

Opalon: Reg. U.S. Pat. Off.

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☐ Please send data on Monsanto OPALON vinyl resin for_____

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that anyone has ever come up with that kind of a miracle. The impression we intended to convey was that most of the members of the Plastics Coatings and Film Association who are now coating or calendering vinyl were originally pyroxylin coaters or rubber calenderers.

Members of the PCFA now assert that 1.5 chairs out of every 10 are upholstered in plastic, and this does *not* include chrome dinette furniture which is almost exclusively vinyl upholstered. Estimates of the percentage of reclining chairs upholstered in plastic range from 30 to 50%; of large upholstered chairs, couches, and rockers from 20 to 55 percent.

Apples to Plastics

IN 1877 Augustus Q. Tucker, a mechanical engineer and owner of extensive apple orchards near Mount Gilead, Ohio, designed a hydraulic press to facilitate pressing apple juice for making cider. This first hydraulic press was so successful that Mr. Tucker formed a company to manufacture hydraulic cider presses. Since cider is a seasonal business, presses were soon developed for use in other industries, and this year, The Hydraulic Press Mfg. Co. is celebrating its 75th anniversary as the world's largest exclusive manufacturer of hydraulic presses.

Commenting on his company's 75-year history, G. B. Robinson, chairman of the board, said:

"One of the most important milestones in the history of hydraulics was contributed by H-P-M in 1926. Up to that time, all hydraulic presses were the so-called water or accumulator operated type. Then, H-P-M introduced an entirely new kind of hydraulic press which was self-contained, automatic in operation, fast-acting, and suitable for many process operations where formerly only mechanical presses were used."

Patents Upheld

A FINDING was handed down in Federal District Court in Chicago last month upholding the Plax Corp., Hartford, in its patent-infringement suit against Elmer E. Mills Corp., Chicago, involving blow-molding of plastic bottles.

Judge John P. Barnes sustained the Plax claim of infringement on three points, but ruled that there was no infringement on a fourth, which covers only a preliminary step.

A judgement order was to be issued later, but Mills announced immediately that an appeal would be taken to the Circuit Court of Appeals. Meanwhile, Mills said, its production of polyethylene bottles will continue full scale to meet present orders and future commitments. A $25,000 bond was posted by Mills to stay an injunction issued by Judge Barnes ordering Mills to stop manufacturing plastic bottles.

Mills contends that its method of blowing plastics differs basically from that covered by the Plax patents, and further that the Plax patents are invalid because they are based on the ancient principles of glass blowing. Judge Barnes said in his opinion that he was convinced that the making of containers of glass and the making of containers of organic plastic materials are not "in the same art."

Electrical Insulating Film

POLYTETRAFLUOROETHYLENE electrical insulating film in a new form that can be fused into a coherent mass after application has been announced by Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn. Designated as PTF, Type B, it is made from unfused Teflon resin in a flexible and stretchable form. It is expected to find wide use for Class H insulation on conductors, coils, condensers, transformers, and other installations operating at high temperatures, frequencies, and voltages.

The material is one of few available in a continuous flexible form that will resist the degrading effect of ozone caused by brush arcing in completely enclosed motors and generators. Its high mechanical shock resistance enables it to be used in the manufacture of printed circuits where ceramic-base materials fail. The highly conformable, non-slippery surface of the unfused film allows it to be applied in place, adhering under slight pressure without the use of an adhesive. The company claims that this adherence provides a better bond to metals and to other surfaces than does a prefused film.

The new film is opaque, but turns cloudy-transparent after being fused. It is the first material of its type available in colors, making it possible to color-code insulated wires meeting Class H requirements. The film is available in 36 yd. rolls in widths from ¼ to 6 in. and in thicknesses of 3, 5, 10, and 15 mils.

Mat-Based Laminate

THERMOSETTING laminate in a new grade which combines high arc resistance with good mechanical and chemical properties has been developed by Synthane Corp., Oaks, Pa. Designated as G-8, this mat-based laminate offers considerable saving in cost over the continuous filament glass base material (NEMA Grade G-5), the electrical properties of which are matched by G-8.

The new material, laminated in thicknesses from 1/16 in. upward, uses a glass fiber mat impregnated with melamine resins. The glass mat base produces a laminate that can machine readily to a smooth surface and that has mechanical properties less directional than those of a woven-base laminate.

G-8 was developed in response to a suggestion by the Navy; the Bureau of Ships is using this grade in buss transfer switches for military applications. In addition to its uses in electrical applications, particularly where arcing may occur, G-8 holds promise for chemical-resistant uses such as in the plating and photographic industries.

Phenolic Molding Compounds

TWO phenolic molding compounds have been announced by Durez Plastics & Chemicals, Inc., North Tonawanda, N.Y. Durez 15528 Black is an all-purpose phenolic that is compounded in such a way as to eliminate corrosion of silver contacts due to a chemical commonly used in the production of many phenolics. This new development was brought about by the constantly increasing use of silver contacts and because closer operating tolerances are being demanded in many electrical devices. Durez 15528 Black has the same

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molding characteristics and physical properties as those currently being used in average electrical applications, but it has a somewhat shorter shelf life before processing into molded parts. The material will preform readily in automatic machines and may be preheated by any existing method. It is available in soft plasticity for easier flowing.

The second compound is Durez 14780 Black, a flexible type phenolic molding material with a synthetic rubber filler which absorbs shock more readily than standard wood-flour or flock-filled materials. It has a low modulus of elasticity which permits its use for molding in thin sections around inserts. It is said to mold equally well by compression or by closed mold molding, and may be preformed in any automatic preforming equipment. Complete data are available from the manufacturer.

Pipe and Welded Fittings

A COMPLETE line of corrosion-resistant plastics piping, tubing, and ducting for use in industry, agriculture, and building is now available from American Agile Corp., P. O. Box 168, Bedford, Ohio. The piping is manufactured in various grades of polyethylene, in both unplasticized and rigid vinyl, and in rigid rubber-resin types, and is furnished in diameters up to 6-in. nominal pipe size. Polyethylene ducting is available in sizes up to 22 in. diameter.

The company's line of piping is complemented with a supply of welded and flanged polyethylene fittings, permitting installation of new plastic pipe lines as well as incorporation of plastic pipe sections and fittings into existing lines.

Electrical Insulation

CURRENTLY available thermoset alkyd plastics now provide electrical insulation resistance that compares favorably with that provided by accepted phenolic and melamine compounds, according to Dr. Maurice H. Bigelow, technical director, Plaskon Div., Libbey-Owens-Ford Glass Co. The required insulation life was achieved by controlling the effect of humidity on the molding compounds. Dr. Bigelow found that by proper selection of the resin base, the filler and silicone treatment of that filler, and by increased monomer concentration, alkyds could be so formulated as to prevent hydrolysis and loss of insulation life caused by humidity. There are now five types of alkyd Plaskon molding materials, including two fiber glass-alkyd materials, with these improved insulating characteristics.

Testing Machines

PILOT coating machines have recently been put in operation in the research department of Mobile Plastics Div., Carlisle Corp., Mobile, Ala. The pilot equipment—a replica of the production equipment, but with more versatility than the large machines—accurately tests the processes which will be duplicated later in large scale operations. It is capable of applying any kind of resin to any kind of material in any reasonable thickness of coating.

The pilots consist of two units—one vertical and one horizontal—to handle materials up to 12 in. in width. They also operate with widths as low as 6 inches. The greatest advantage of tests run on the pilot machines is that they do not tie up regular production since test operations are independent.

PEA Elections

AT the recent meeting of the Plastics Engineers Association, the following officers were elected for the coming term (Oct. 1952 to May 1953): president, Bert Lahey, Boonton Molding Co.; vice president, Joe Eder, S. Sapery Co.; secretary, Fred Kay, Standard Plastics Co.; treasurer, Peter Carley, Waterbury Companies, Inc.

In accordance with a new policy concerning the Board of Directors, the following seven directors were appointed on a semi-permanent basis: Chris Groos, Boonton Molding; Nick Klein, Injection Molding; Fred Stanley, MODERN PLASTICS; S. Sapery, S. Sapery Co.; Fred Meacham, Northern Industrial Chemical Co.; Harry Jamison, H. Jamison Co.; and William Cleworth, Cleworth Publications. The remaining five directors, who will be elected annually, are: Bob Coombs, Steiner Plastics; Art Jacobs, Ideal Plastics; Frank Kelsey, Garfield Mfg. Co.; Harold Ogust, Molded Resin Fiber Co.; and E. E. Telsen, S. S. White Dental Mfg. Co.

SPI Officers

AT the annual business meeting, the Society of the Plastics Industry reelected Gordon Brown, Bakelite Co., as president and Horace Gooch, Jr., Worcester Moulded Plastics Co., as chairman of the board, both for a second year effective June 1. Newly elected vice president is J. E. Gould, Detroit Macoid Corp.; the new secretary-treasurer is John J. O'Connell, Consolidated Molded Products Corp.

Directors elected for the next year are as follows: Canadian Section, Howard Yates, Crystal Glass & Plastics, Ltd.; Midwest Section, Earl R. Keown, Santay Corp.; New England Section, George V. Sammet, Jr., Northern Industrial Chemical Co.; Pacific Coast Section, Lee T. Bordner, Sierra Electric & Mfg. Co.

During the last ten years the plastics organizations belonging to this industry association have increased from 182 companies in 1942 to 713 at the present time.

EXPANSION

Nu-Dell Plastics Corp., 2250 N. Pulaski Rd., Chicago, Ill., has purchased the houseware molds of **Popeil Bros., Inc.**, Chicago. The company already produces canister sets, bread boxes, cake covers, waste baskets, and pantry sets.

Ferro Corp. has opened a million dollar fibrous glass plant in Nashville, Tenn., and has created a new Fiber Glass Div. at 200 Woodycrest Ave., Nashville, under the direction of **W. G. Cole, Jr.** The new plant, consisting of four factory buildings occupying more than 24,000 sq. ft. of space, will produce a uniform mat 48 in. in width and rolled into a continuous length, In order to build up a specialist position, the company will concentrate on development and production techniques for other manufacturers interested in fibrous glass reinforcement of plastic parts.

Durez Plastics & Chemicals, Inc., has purchased a 100-acre plant site at Reesedale, Pa. The company has

YOU'LL GET BETTER *Flex-Appeal* IN YOUR VINYL PLASTIC FILMS WITH *Baker Plasticizers*

The ideal plasticizer should impart flexibility that persists over a wide range of temperatures. It should give film pliability, softness, drape, or hand at all times. To an outstanding degree the plasticizers listed below impart these qualities to polyvinyl chloride type resins. They give flexibility that is particularly effective at subzero temperatures.

And these Baker plasticizers offer a *plus value*. They are effective processing aids, acting as anti-stick agents during calendering operations. The hot PVC films are readily released from the rolls, making a high production rate possible.

PRODUCT	CHEMICAL NATURE	SPECIFIC GRAVITY 25°C/25°C	VISCOSITY (Poises) 25°C	ACID NO.
RICINOLEATES				
Flexricin® P-4	Methyl Acetyl Ricinoleate	.937	.22	2.2
Flexricin P-4C	Methyl "Cellosolve" Acetyl Ricinoleate	.960	.24	2.8
Flexricin P-6	Butyl Acetyl Ricinoleate	.928	.23	2.2
Flexricin P-8	Glyceryl Tri (Acetyl Ricinoleate)	.967	2.3	2.0
PG-16	Butyl Acetyl Polyricinoleate	.913	.21	2.6
ACETOXYSTEARATES				
Paricin® 4	Methyl Acetoxystearate	.934	22	2.4
Paricin 4C	Methyl "Cellosolve" Acetoxystearate	.953	32	3.6
Paricin 6	Butyl Acetoxystearate	.924	32	4.0

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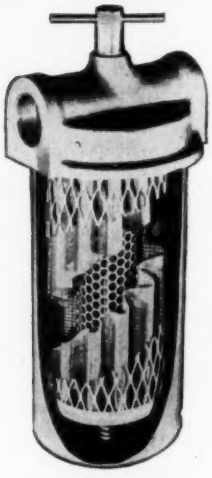
PROTECT HYDRAULIC EQUIPMENT

SUMP TYPE (cutaway)

with

MARVEL SYNCLINAL FILTERS



LINE TYPE (cutaway)

DEPENDABLE PROTECTION in HYDRAULIC and LOW PRESSURE SYSTEMS

With the ever increasing demand for more production from new and existing machinery, Marvel Synclinal Filters are playing an important part in converting maintenance "down-time" to increased "producing time."

LESS MAINTENANCE

Because Marvel Synclinal Filters may be disassembled, cleaned and reassembled in a matter of minutes by any workman, filter maintenance "down-time" is reduced to the absolute minimum.

GREATER EFFICIENCY

Because of the combined, outstanding features, in both construction and performance, Marvel Synclinal Filters bring about the greatest degree of efficiency in all production equipment where filtration of liquids is of the utmost importance.

MORE PRODUCTION

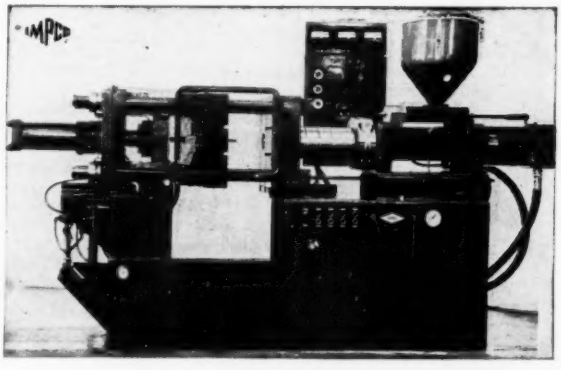
The balanced synclinal design of Marvel Filters leaves plenty of space for storage of foreign matter, without flow interference or pressure build-up. Therefore longer periods of productive operation are attained.

FACTS NOT CLAIMS

Because engineers decided on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety—

OVER 270 MANUFACTURERS
Specified
MARVEL SYNCLINAL FILTERS
as their O.E.M. Choice

Marvel Filters are available in sump and line type models, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe fittings. For efficient filtration of liquids in all HYDRAULIC and LOW PRESSURE systems investigate Marvel Synclinal Filters.



IMPCO HA4-175 4 to 6 Oz. Plastic Molding Machine. Marvel Synclinal Filters protect the hydraulic systems in Impco's complete line of molding machinery, and are installed as standard equipment. Photo Courtesy Improved Paper Machinery Corporation Nashua, New Hampshire.

★

WATER FILTERS

In response to the great demand, we have adapted both our sump and line types for use in all water filtering applications. No changes have been made in the basic synclinal design.

Write for Complete Engineering Data
—specify Oil or Water

Meets J. I. C. Standards

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not stated what part of its operations will be located at the new site.

DeBell & Richardson, Inc., Hazardville, Conn., has established a separate corporation for the pilot manufacture of plastics materials and products developed in its laboratories. The new company, known as **D & R Pilot Plants, Inc.,** is headed by **Henry M. Richardson,** president, and **John M. DeBell,** treasurer. **DeBell & Richardson, Inc.,** continues its research and development activities for the plastics industry without change of ownership.

Fiber Glass Div., Libbey-Owens-Ford Glass Co., has announced the purchase of the Garan fiinsh and acquisition of certain technical services of **Dr. Robert Steinman,** president of Garan Chemical Corp., Los Angeles, Calif., including all patent properties and the good-will associated with the trademarks Garan and Garan Finish. Garan finish is a surface treatment developed by Dr. Steinman which, when applied to glass fibers, gives them superior characteristics for reinforcing plastics, and is of particular importance to the aircraft industry.

Quaker Oats Co. has announced plans to build a $600,000 addition to its furfural manufacturing facilities at 3324 Chelsea Ave., Memphis, Tenn. This new plant, expected to be completed in 1953, will make furfuryl alcohol by processing further some of the furfural now produced at the plant. Furfuryl alcohol is used as a solvent and plasticizer in the manufacture of abrasive wheels, as a binder for fibrous material such as glass used in wrapping underground pipe lines, and as an additive in glue used in the plywood industry.

Borden Co. has started operations at its new $1 million chemical plant at Demopolis, Ala., the first in the Southeast to manufacture formaldehyde, synthetic resins, and hexamethylene-tetramine. Initial annual production will approximate 20,000,000 lb. of formaldehyde, 24,000,000 lb. of synthetic resins, and 1,200,000 lb. of hexamethylenetetramine, an intermediate product used by the plastics and chemical industries in the manufacture of other products. The formaldehyde will be used principally by the Demopolis plant and its sister Borden Plant at Kernersville, N. C., in the manufacture of synthetic resins to be used as adhesives and bonding agents.

Ideal Toy Corp., 200 Fifth Ave., New York, N. Y., has acquired 35,000 sq. ft. of manufacturing space for its Inflated Vinyl Div. The additional facilities, located in the Jamaica, N. Y., plant formerly occupied by Ideal Latex Corp., will be devoted to producing new-type inflatable wading pools to be introduced by Ideal in 1953.

Union Carbide and Carbon Corp. has announced its purchase of the 282-acre estate of James Butler near Elmsford, N. Y., where it plans a $12 million development of executive offices and research laboratory. Most of the company's 4500 New York employees are now housed at 30 E. 42 St. Construction of the new headquarters is expected to start as soon as certain rezoning problems have been ironed out.

Tennessee Eastman Co. recently opened its new sales service laboratory at Kingsport, Tenn. In the section devoted to plastics research, most of the work is in connection with the evaluation of plasticizers, stabilizers, short-stops, and ultra-violet inhibitors. Plastics formulations are compounded, polymerization reactions carried out, and various types of plasticizers prepared.

Formica Co. is installing a giant press at its new Evendale plant which, when in operation by this Fall, will turn out 4480 sq. ft. of Formica in a single run. The press—three stories high and weighing half a million lb.—was built by **The Baldwin-Lima-Hamilton Corp.,** Philadelphia, Pa.; total cost of the project, including auxiliary equipment, is estimated at $1,500,000. With this new equipment Formica decorative sheets can be produced in a size 4 ft. wide and 10 ft. long (1 ft. wider and 2 ft. longer than the largest size now manufactured), which will eliminate the need for joints on many installations.

Tupper Corp., Farnumsville, Mass., has acquired a 1000-acre plot at Orlando, Fla., and has started construction on a new office building with more than 40,000 sq. ft. of space for Tupperware Home Parties, Inc. It is expected to be ready for occupancy by September. The company also announced plans for a second building, containing 100,000 sq. ft. of floor space, on the new site.

COMPANY NOTES

Monsanto Chemical Co. has announced the following changes and appointments in its personnel. **James R. Turnbull** has been appointed assistant general sales manager of the Western Division. He will assume his new duties with headquarters in Seattle this fall. He will continue to serve his present assignment for Monsanto's Executive Committee and assist in the marketing program for Krilium soil conditioner until that time. A native of Tacoma, Wash., Mr. Turnbull joined the company's Plastics Div. in 1938 after serving as advertising service manager with Marshall Field Co. in Chicago. He was chief of the Thermoplastics Div. of the Plastics Section of WPB during World War II and then returned to Springfield, Mass., where he was general sales manager of the Plastics Div. until his special assignment with the company's Executive Committee last September.

Richard C. Evans has been named general manager of sales of the Plastics Division. He joined the company in 1940 and has been an assistant general manager of sales since last fall. **Charles Lichtenberg** has been named assistant to the general manager. He was operations vice president of **Resinox Corp.** when that concern was purchased by Monsanto in 1939 and has continued to serve as vice president of the Resinox subsidiary and also as molding materials sales manager. He was made assistant general manager of all sales in 1947. **R. Allen Gardner** has been appointed sales promotion and advertising manager of the company's new Merchandising Div. in St. Louis. The first product to be handled by this new division is Krilium soil conditioner. The general manager of the division is **Roy L. Brandenburger**

PLASTISCOPE

who joined the company in May after serving as manager of the Sanitation Farm Supply Div. of Ralston Purina Co.

Plax Corp., Hartford, Conn., has appointed **Wurzburg Brothers, Inc.**, Memphis, Tenn., as distributor of Plaxpak bottles for Tennessee, Mississippi, Louisiana, Alabama, and Arkansas.

Goodyear Tire & Rubber Co. has made the following appontments to the sales staff of the Pliofilm Dept.: **G. S. Haney, Frank H. Kimball,** and **R. W. Anderson.**

Pittsburgh Coke & Chemical Co. has elected **W. Kenneth Menke** to the newly created post of vice president in charge of chemicals. Mr. Menke, who recently came to the company from Monsanto Chemical Co., heads the firm's rapidly expanding chemical activities. Announcement was also made of the appointment of **Edison H. Shaw** as Cleveland district sales representative for the Plasticizer Div.

Hercules Powder Co. has named **Charles A. Grant** to the post of Chicago district sales manager for the Cellulose Products Dept. **J. G. Antonak** replaces **G. E. Osburn,** who has been transferred to Wilmington, as Chicago technical representative for the Synthetics Dept.

Firestone Plastics Co. has assigned **R. W. Briner** to the New England territory as sales representative for the Chemical Sales Div. His headquarters are at Main and Ely Streets, Hartford, Conn. **Kenneth L. Edgar** has been appointed manager of manufacturers' sales. He will handle the sale of Velon films and sheetings from the firm's plant in Pottstown, Pa.

Taylor Fibre Co., Norristown, Pa., announces the election of **John M. Taylor** as chairman of the board, **Merritt H. Taylor** as president, **Clifton N. Jacobs** as vice president in charge of research and engineering, and **John M. Taylor, Jr.**, as vice president and secretary.

Lakeside Plastics Corp., 2214 Franklin St., Manitowoc, Wis., has changed its corporate name to **Lapcor Plastics, Inc.**

Goodall Fabrics, Inc., 525 Madison Ave., New York, N. Y., has established a new Plastics Div. to handle the sale of all plastics and coated fabrics manufactured by the company's plant in Reading, Mass. These products were formerly sold through the Industrial Division. **Peter P. Shea** has been named divisional manager and **R. F. Daughters** sales manager.

Reed-Prentice Corp., Worcester, Mass., has moved its Chicago branch sales office to new quarters at 4001 N. Elston Ave.

K-Plastix has opened its new plant at 55 Elmira St., San Francisco, Calif.

Leaf Plastics, Inc., has moved to larger quarters at 135 Woodworth Ave., Yonkers, N. Y.

Metal & Thermit Corp., 100 E. 42 St., New York, N. Y., has appointed **Louis A. Tomka** to head a newly established technical service department which will be devoted to the problems of its customers in the plastics industry. **Herbert E. Hirschland** is director of research.

Commercial Plastics & Supply Corp., distributor of acrylic and acetate sheets, rods, and tubes, has moved to new offices at 630 Broadway, New York, N. Y.

Merritt Products Co., Inc., 1547 E. 28 St., Cleveland, Ohio, has announced the formation of a Plastic Specialties Div. headed by **Don Conroy.** The new division prints, silk screens, polishes, laminates, and forms plastics sheet and film, and has heat-seling, punching and die-cutting facilities.

Naugatuck Chemical Div. has appointed **Robert P. White** and **Carl W. Virgin** as technical sales representatives for Marvinol, Kralastic, and Vibrin resins. Mr. White will make his headquarters in the company's main plant at Naugatuck, Conn.; Mr. Virgin will be in the New York office at 254 Fourth Ave.

Libbey-Owens-Ford Glass Co. has reassigned two molding compound sales representatives for the Plaskon Div. **C. B. Wing** goes to the Boston office and **Richard S. Baumgartner** replaces him at the Sayre, Pa., office. Personnel changes in the Fiber Glass Div. include the appointment of **J. M. Johns** as general manager and **G. O. Hartzell** to the sales staff in the central region.

Rel Plastics Corp., a new company specializing in injection molding proprietary plastics products, is now in full operaton at 475 Boulevard, East Paterson, N. J.

Celanese Corp. of America announces that **W. D. Matthews** has joined the Organic Chemical Dept. as a sales representative. **W. D. Morrison** has been appointed assistant manager of the Product Development Dept.; **Alan K. Jeydel** and **Michael J. Curry** have joined that department as product development engineers, and **G. H. Wiech** as a technical service engineer. **Harold L. Sheppard** has been named manager of plant operations of the Plastics Div.'s Newark and Belvidere, N. J., plants.

B. F. Goodrich Chemical Co. has announced the appointment of **J. E. Pittenger** as Geon materials sales representative in the Detroit area. Mr. Pittenger joined the company in 1943 and was senior sales representative in New York. **Robert E. Score** will handle the sale of Good-rite organic chemicals on the East Coast and in southeastern states, with offices at 475 Fifth Ave., New York, N. Y.

The Dow Chemical Co. has made the following personnel changes in the Plastics Dept.: **Dr. William H. Schuette,** manager of the newly formed plastics production department; **Max Key,** manager of saran porduction; **Earl L. Collins,** manager of polystyrene production; and **Albert T. Maasberg,** manager of cellulose products production. **Robert E. Reinker** has been named technical adviser to the president of **Asahi-Dow Ltd.**, recently formed associate of **Dow Chemical International, Ltd.**, and the **Asahi Chemical Industry Co., Ltd. of Japan. Louis C. Friedrich, Jr.**, replaces him as superintendent of the saran polymer plant at Midland, Mich. **M. F. Ohman** has been appointed to the new post of assistant general manager of the

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Western Div. Mr. Ohman, formerly the division's production manager, will continue to make his headquarters at the firm's Pittsburgh plant.

Hale & Kullgren, Inc., designer of machinery and processes for the plastics and rubber industries, has moved to larger quarters at 613 E. Tallmadge Ave., Akron, Ohio. The company was formed two years ago by Hale and Kullgren, both formerly associated with Farrel-Birmingham Co. and Adamson United Co. The move to new offices became necessary when the Aetna-Standard Engineering Co., who build the equipment designed and sold by Hale & Kullgren, acquired the **Rubber & Plastics Div. of National-Erie Corp.**

PERSONAL

Marius Van de Weghe, who has been chief chemist and superintendent of the **Plastics Div. of Colt's** for 14 years, has organized his own company at 76 Silver St., New Haven 11, Conn. He will start compression molding immediately and go into injection molding in about six months.

Charles A. Breskin, publisher of MODERN PLASTICS and president of Breskin Publications, was elected to the Board of Directors of the American Management Association for the 1952-1955 term.

E. E. Ellies has resigned as manager of the **Films & Flooring Dept.,** The Goodyear Tire & Rubber Co., where he was in charge of Pliofilm sales, to become vice president and director of sales of **Transparent Packaging Co., Inc.,** Chicago, Ill. Mr. Ellies, an authority on transparent packaging, had been with Goodyear since 1930. **R. R. Stigler,** vice president of Transparent for many years, will assume the duties of national accounts manager and **L. B. Tauber,** vice president in charge of Eastern Division Sales, has been placed in charge of the entire United States sales staff as field sales manager, with headquarters in Chicago.

Harold V. Williams has been named manager of the **Process Equipment Dept., Blaw-Knox Co.,** succeeding **Bruce Alexander** who has been transferred to the **Chemical Plants Div.**

Wayne F. Anderson has been appointed sales representative for the **Rubber & Plastics Div., John R. MacGregor Lead Co.,** Chicago, Ill. Mr. Anderson's offices are located at 547 Aqueduct St., Akron, Ohio.

Raymond C. Platow, formerly with **Bell Telephone Laboratories,** has joined the research and development staff of **U. S. Plywood Corp.,** 55 W. 44 St., New York, N. Y., as chief materials engineer.

Robert Benson has been promoted to assistant sales manager, **Omega Machine Co.,** Providence, R. I.

Ernest C. Schultz has been named to head the Dept. of Research and Development, **Russell Reinforced Plastics Corp.,** Lindenhurst, N. Y.

Edward Mrugacz has been appointed sales manager for the **Plastic Div., Sinko Mfg. & Tool Co.,** 3135 W. Grand St., Chicago, Ill.

Dr. Russell B. Akin has been transferred to the plastics sales section of **Du Pont's Polychemicals Dept.,** covering a northern New Jersey territory and reporting to the New York office at 350 Fifth Ave. Dr. Akin joined Du Pont in 1937 and has served as technical advisor to the New York sales office since 1949.

Dr. Foster Dee Snell, president of Foster D. Snell, Inc., received the Honor Scroll Award of the New York Chapter of the American Institute of Chemists. The scroll is awarded anually to a chemist making an outstanding contribution to his profession.

W. J. Trautweiler has been promoted to the post of chief engineer, in which capacity he will head the Estimating, Sales, Service, and Engineering Departments of **Newark Die Co.,** 20 Scott St., Newark 2, N. J. Mr. Trautweiler, formerly superintendent of the Light Moldmaking Div., has been with the moldmaking firm for 15 years.

G. D. Jefferson, formerly East Coast manager of Corrulux Corp., has been made vice president and general sales manager of the company, with headquarters at the main offices, 410 Holmes Rd., Houston, Texas.

Mr. Jefferson, a pioneer in reinforced plastics, was previously in charge of the alkyd operations at Atlas Powder Co.

Deceased

E. J. A. Gardiner died of cancer April 26, 1952. Mr. Gardiner, whose company operated under the name of **Gardiner Brothers,** San Francisco, has been in the plastics business for 55 years and was one of the original representatives of the **Celluloid Co.** on the West Coast where he first entered the employ of P. J. Tormey, who was operating as manufacturer's representative in San Francisco. The business of Gardiner Brothers will be continued by his widow, **Ruby K. Gardiner.**

MEETINGS

Sept. 9-13—American Chemical Society, Seventh National Chemical Exposition, Chicago Coliseum, Chicago, Ill.

Sept. 11-13—American Institute of Chemical Engineers, Palmer House, Chicago, Ill.

Sept. 11-14—Packaging Machinery Manufacturers Institute, 20th Annual Meeting, Homestead, Hot Springs, Va.

Sept. 18-29—National Homefurnishings Show. Fourth Annual Exhibit, Grand Central Palace, New York, N. Y.

Oct. 29-31—American Society of Body Engineers, Seventh Annual Technical Convention, Rackham Memorial Bldg., Detroit, Mich.

Dec. 7-10—American Institute of Chemical Engineers, Annual Meeting, Hotels Cleveland (headquarters) and Carter, Cleveland, Ohio.

S.P.E. Meetings

Sept. 19—Mr. F. W. Reynolds, International Business Machines Corp., will address the Buffalo Section on "Plastics, A Case History."

Oct. 17—Mr. Paul Elliott, Naugatuck Chemical Div., will speak to the Buffalo Section on "High Impact Styrenes and Copolymers."

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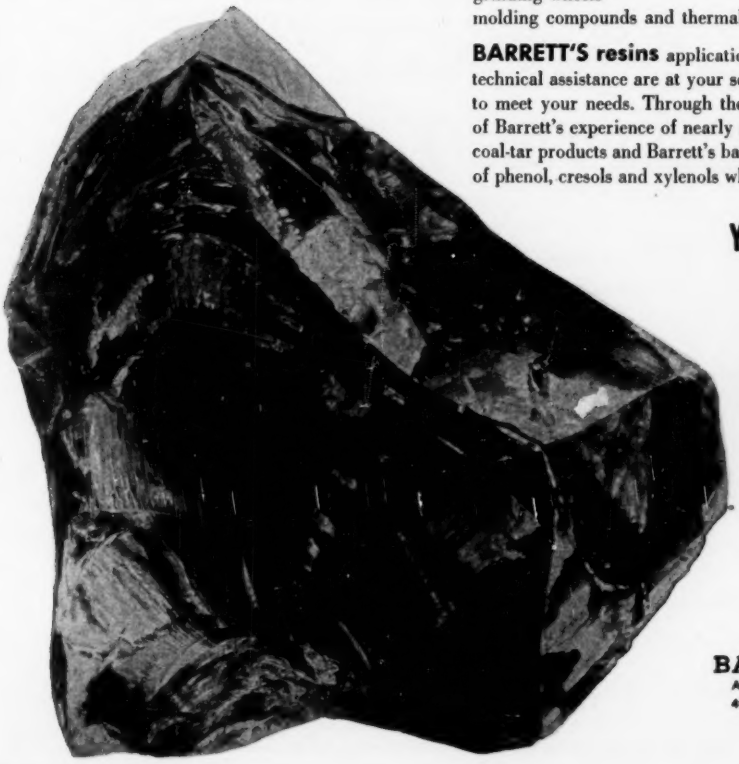

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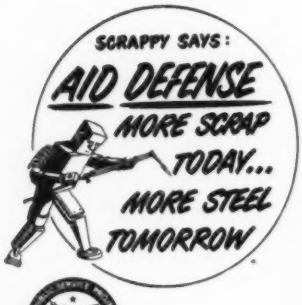

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We handle hydraulic presses, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. Hydraulic Sal-Press, Inc., 386-90 Warren Street, Brooklyn 2, N.Y. MAin 4-7847

FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater, Model C B. Like new. AARON MACHINERY CO., INC. WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

FOR SALE: Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars address Box 1606 Modern Plastics.

FOR SALE: 1 Ball & Jewell No. 1½ Rotary Cutter, stainless steel construction, with 30 HP motor. Also Kux and Stokes Rotary Pellet Presses. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

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FOR SALE: De Mattia Chunk Grinder. Floor model. 3 horse power 220-three phase motor. Excellent condition. $375.00, SHELLEY PRODUCTS LIMITED, 220 Broadway, Huntington Station, N. Y.

FOR SALE: One 24-oz. Watson-Stillman Injection Molding Machine. Can be inspected in operation. Also, extra 18-oz. and 24-oz. cylinders, rams, and bushings. Write Box 1614, Modern Plastics.

FOR SALE: Buttondex machines, used but in excellent condition. Reply Box 1625, Modern Plastics.

FOR SALE: 3000 ton 6-daylight Board Press by John Shaw & Sons; steam heated platens 8'6" x 4'4", with self-contained Pumping Equipment, mounted above Press; unused. 2650 ton Sheeting or Belting Press by Hydraulik of Duisberg; steam platens 18' x 7'4"; six rams; with self-contained Air Hydraulic Accumulator and Pumps. 2600 ton 6-daylight Board Press by Greenwood & Batley; steam heated platens 6'4" x 3'3", with loading and unloading gear. 2000 ton Downstroke Press by Fielding & Platt; table 5' square; daylight 6'. Many other smaller Hydraulic Presses, also Pumps and Accumulators. REED BROTHERS (ENGINEERING) LTD., Replant Works, Cuba St., Millwall, London, E. 14, England. Telegraphic address REPLANT LONDON.

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FOR SALE: 3000 pounds Flesh and Pink Butyrate Molding Powder, reground 28¢ per pound. Reply Box 1617, Modern Plastics.

FOR SALE: 5,000 sheets new masked acrylic, 1/16" x 12" x 23" at $1.25 per sheet. All other gauges in clear and colors at discount. DUKE PLASTICS CORP., 406 Atlantic Ave., Brooklyn 17, N. Y. ULster 8-9413.

FOR SALE: Vinyl Plastisol Scrap—50,000 pounds, clean, sorted, ready for shipment, steady supply. Also large quantities Polyethylene Scrap—clear cuttings, and camelback type. Virgin Vinyl Resins, original packing, below market price. K. M. AARON COMPANY, INC., 7 Brown St., Newark 5, N. J. (Market 3-5907)

FOR SALE: Sheet Vinyl scrap. 10,000 lbs. 4 gauge print on clear, also 10,000 lbs. print on opaque. Very clean condition. Also 8,000 lbs. of 020 gauge in solid colors, separated, blue, green, red, white, brown, gray. Also polyethylene sheet, clear sheet scrap, 2,000 lbs. 5,000 lbs. 04 gauge clear sheet scrap. Nylon scrap. Quote offers first instance. Reply Box 1618, Modern Plastics.

(Continued on page 206)

CLASSIFIED ADVERTISING

(*Continued from page 204*)

MATERIALS WANTED

WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 1603, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic Ethyl Cellulose. Reply Box 1604, Modern Plastics.

WANTED: Plastic scrap such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. Claude P. Bamberger, Inc., 152 Centre St., Brooklyn 31, N. Y. Tel. Main 5-5553. Not connected with any other firm of similar name.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. Franklin Jeffrey Corporation, 1671 McDonald Avenue, Brooklyn, N. Y. ES 5-7943.

MOLDS FOR SALE

FOR SALE: Patented cigarette and match case. Highest quality hobbed injection mold suitable for 8 ounce Reed Prentice press. Molds 5 tops and 5 bottoms each cycle. This is a real opportunity for firm with distribution in the advertising novelty or tobacco accessory field. Write H. L. Auten, 117 Carrol Ave., East Peoria, Illinois.

MOLDS WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to Victory Manufacturing Company, 1722 W. Arcade Place, Chicago 12, Illinois.

BRUSH MOLDS WANTED FOR CASH: Injection molds for ladies', men's, military, nail, tooth, brushes, etc. Send particulars and samples. Box 51, Realservice, 110 West 34th St., N.Y.C.

WINDSHIELD SCRAPER MOLD WANTED: We need a well designed windshield scraper mold to fit a 8-oz. Reed-Prentice machine. Forward sample parts and full details including asking price. We are also interested in other plastic automotive items. Reply Box 1627, Modern Plastics.

HELP WANTED

SALESMEN FOR ESTABLISHED CHICAGO INJECTION MOLDER with capacity to 200 oz. Prefer experience in plastics and capable of giving some engineering service to customer. Will consider men controlling one account or deal. Men required in all industrial areas plus man for Chicago office. Applicant assured excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Give complete details to Box 1605, Modern Plastics.

PLASTICS ENGINEER experienced in the production problems of Polyethylene extrusion. Wanted to set up and supervise production department. Large national organization. Write stating complete background and qualifications, salary, etc. All replies will be held in strict confidence. Reply to Box 1637, Modern Plastics.

PLASTIC EXTRUSION MANAGER wanted by Chicago concern. Must be experienced and capable of operating complete department. Reply Box 1609, Modern Plastics.

EXPERIMENTAL TOOL AND DIE MAKER wanted by Research Division of West Coast fabricator of structural plastic aircraft components. Must be familiar with tooling necessary for forming, laminating and extrusion of resin-filled glass fabrics, mats and rovings. Must have initiative and ability to work well with research engineers. Submit resume, recent snapshot and salary requirements. Reply Box 1640, Modern Plastics.

SALES ENGINEER: An expanding medium sized firm located in Connecticut since 1832 has an opening with excellent opportunities in their Sales Department for a qualified man to cover the Philadelphia area. Desirable to have an engineering degree or engineering background, preferably with sales experience, but not necessary. Should be between 25 and 35 years of age. Guaranteed earnings plus expenses the first year; straight commission plus expenses thereafter. This organization is a creator and fabricator of unique fibrous and plastic materials. Interested men are invited to write for further particulars and submit a resume of their experience and training, a recent photograph, and salary expected. Reply Box 1608, Modern Plastics.

PACKAGING MATERIALS MANUFACTURER wants technically trained man with extensive background in application, development and technical service of thin films for wide variety of packaging uses. Good opportunity for advancement in large company. Replies will be kept confidential but must include complete details of personal data, training, experience, salary and location requirements and references. Reply Box 1610, Modren Plastics.

SALES REPRESENTATIVE wanted—PHENOLIC RESINS. Willing to make commission arrangement if so desired. Our men have been advised about this advertisement. Reply Box 1612, Modern Plastics.

CHEMICAL OR MECHANICAL ENGINEER: Well established manufacturing corporation located in very desirable section of southeast requires chemical or mechanical engineer approximately 30 to 40 years of age with 7 to 12 years experience in design and operation of organic chemical plant, and preferably with supervisory experience, to be in charge of designing new development unit in plastic field. Please send complete resume regarding education, experience, and personal information to Box 1638, Modern Plastics.

MOLDER'S SALES REPRESENTATIVE: Strong, established custom molder in Chicago area, requires services of experienced, full time salesman for Midwest territory. Must know compression and injection molding. Write, giving full details to Box 1615, Modern Plastics.

SYNTHETIC RESIN CHEMISTS: The following openings are available for chemists on expanding staff of growing, progressive resin manufacturer: Group Leader—Research, Group Leader—Development, Research Chemists. Emphasis on industrial phenolics and molding compounds with experience in other resin types desirable. Western New England location. Reply Box 1619, Modern Plastics.

SALESMEN OR SALES ENGINEERS—for growing Long Island, New York custom injection molder. Must have proven sales ability in servicing industrial and consumer type accounts. Opportunity to earn high income by capitalizing on excellent molding facilities, conveyorized assembly, large paint spraying dept., vacuum metalizing equipment, own die shop and engineering dept. Submit full resume of qualifications, experience, and references. Confidential. Reply to Box MP 1637, 221 W. 41st St., N. Y.

CALENDERED PLASTICS DEPARTMENT SUPERINTENDENT, high calibre man required to take charge of production on a three shift calendered vinyl film operation. Must have broad background in this field including familiarity with compounding and machinery. New, modern plant in metropolitan New York area. Give full details on background and salary required. Replies confidential. Reply Box 1639, Modern Plastics.

PACKAGING REPRESENTATIVES WANTED: Pioneer plastic container manufacturer offers good additional packaging line. Drugs, sundries, small industrial tools and parts, notions, fishing supplies and small items. Commission. Reply Box 1628, Modern Plastics.

WANTED by West Coast materials manufacturer, plastics engineer or chemist for technical sales and some laboratory work. Reply Box 1632, Modern Plastics.

SITUATIONS WANTED

AVAILABLE AT ONCE, Plant Superintendent, familiar with all phases of injection molding. Extensive experience in organization, production, and tool design. Will relocate. Reply Box 1634, Modern Plastics.

PLASTICS ENGINEER: Graduate chemical engineer. Over 8 years experience with thermoplastics. Extrusion of flat and tubular films, compounding, coloring and pelletizing, extrusion-coated paper and foil, improvng printability of polyethylene. Production supervision, process and product development, chemical and mechanical problems, improvement of physical properties of films. Professional member, SPE. Age 31. Family. Will relocate. Seek permanent connection with progressive organization. Reply Box 1623, Modern Plastics.

PLASTICS ENGINEER: With 6 years practical experience as Assistant Plant Manager of plants doing custom and proprietary compression, injection and transfer molding. Experience includes molding and fabricating of glass-bonded mica (Grade L-4 insulation) as well as usual molding materials. Desire connection with progressive firm. Age 33. Married. B.S. Engneering. Will relocate. Address reply Box 1622, Modern Plastics.

APPLICATION RESIN CHEMIST: Married 32 year old veteran, five years experience with large corporation, desires responsibility and opportunity in smaller company in resin industry. Completely familiar with production procedures and administration of laboratory budgets and activities. Vast experience with polyester resins and phenolic varnishes, room and elevated temperature cure and high and low pressure laminating processes. Box 1620, Modern Plastics.

SERVICES OFFERED

WANTED FOR EXPORT—Products for the Plastics Industry. Long established export department of well rated plastics manufacturer wants additional items, such as raw materials, semi-finished products, machinery and equipment, for foreign distribution, preferably on an exclusive basis. Efficient handling of correspondence and export technicalities; complete financing. Competent resident representatives in many countries. Reply Box 1616, Modern Plastics.

PLASTIC EXPORTS: Well established, independent, plastic export company specializing in raw materials, wishes to expand operations and is interested in plastic machinery, semi-finished and finished articles, for sale in foreign countries. Will take care of all correspondence, documentation, shipping arrangements, etc. and accept deliveries FOB plant against domestic payment terms. Reply Box 1624, Modern Plastics.

MISCELLANEOUS

PREMIUM ITEMS WANTED. All types, including house-hold and kitchen items for national sales and distribution. Direct contacts with over 1,200 permium users through quick, direct methods. Reply Box 1629, Modern Plastics.

FOR SALE: Small custom molding and fabricating company. Good backlog of defense work. Plant equipped for short run injection and compression molded parts, Vacuum & Press forming & Fiberglas laminating. At present supplying wide range of aircraft parts to the aviation industry. Will sell all or part interest. Reply Box 1636, Modern Plastics.

BUSINESS FOR SALE: Small going extrusion plant with process involving plastic coverings in northern N. J. Equipment in running shape with complete list of our active customers. You simply move in and produce; will buy itself off within almost a year. Patent research with favorable results; potential for expansion good. Will train your men. Call GRegory 3-5935.

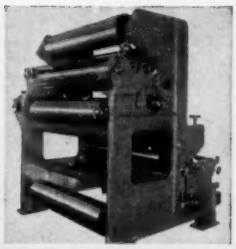
INTERESTED IN PURCHASING small injection molding plant in the Chicago Area. Also interested in purchasing 8 oz. press. Please give full particulars. Reply Box 1630, Modern Plastics.

All classified advertisements payable in advance of publication

Up to 60 words	$10.00	Up to 120 words	$20.00	Up to 180 words	$30.00
Up to 60 words (boxed)..	$20.00	Up to 120 words (boxed)..	$40.00	Up to 180 words (boxed) ..	$60.00

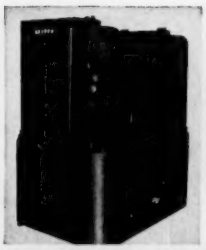
For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

Coater Laminator for paper and foil

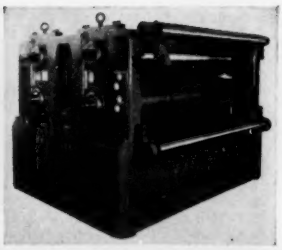


Triplex Board Laminator

Laminators for every purpose



Single Embosser



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DIVISION OF THE BLACK-CLAWSON COMPANY

Fulton, New York

Plastics Engineer

● Graduate engineer with approximately five years experience in application or testing of plastic materials, primarily thermoplastic and thermosetting molding materials and laminates, for work in Plastics Laboratory. Should have a good knowledge of physical properties of plastics.

Excellent working and living conditions, good salary, moving expenses paid, exceptional employee benefits.

Write, giving full details, including education and experience, to:

R. H. Austin, Personnel Director, International Business Machines Corporation, Endicott, New York.

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PRESSURE CASTINGS

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- Multiple cavities and cores of intricate shape
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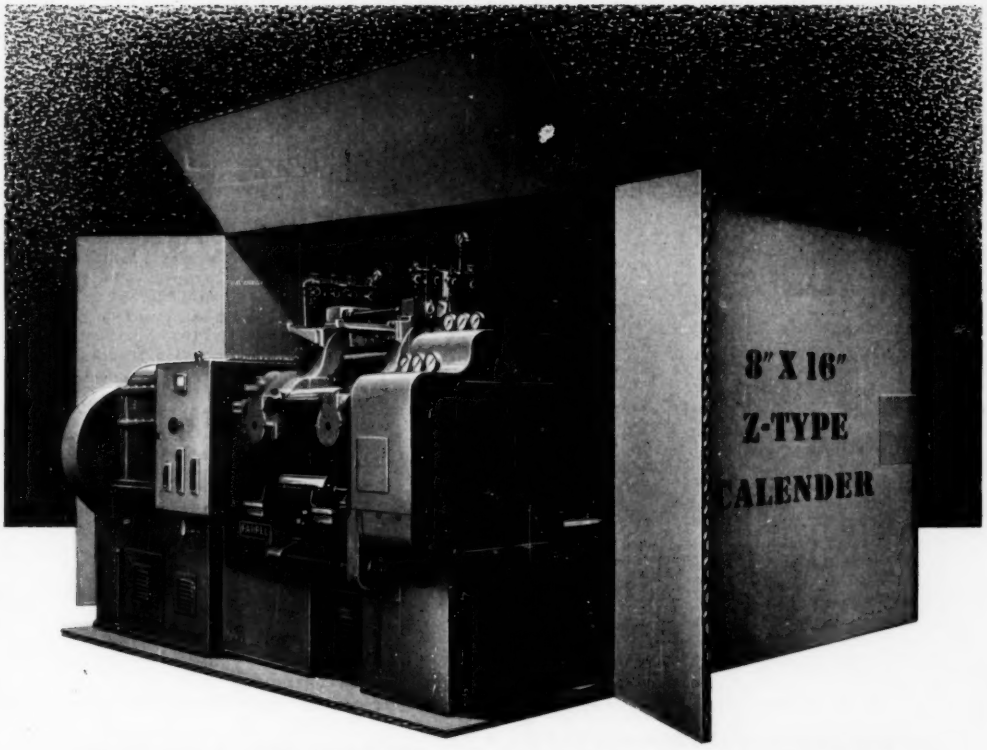
AUGUST 1952

(*Continued on page 210*)



HERE IS MAXIMUM CALENDER VERSATILITY IN A SINGLE PACKAGE

This 8" x 16" four-roll Z-type calender is probably the most highly versatile experimental machine of this type ever built. The drive arrangement permits flexibility in roll speeds and ratios for experimentation in single and double coating, sheeting, and running unsupported plastic film of very light gauges.

The drive motor furnishes adjustable speed for the four calender rolls, and a unique arrangement of gears and clutches provides variables in roll speeds one to another. This means that, by a simple movement of clutch levers, the rolls may be set at related speeds determined in advance to be most advantageous for the work to be done.

The rolls are bored and equipped with rotary joints for the circulation of temperature-controlling fluid. Gauge adjustment of all but the fixed lower roll is by hand ratchet. The use of clutches on the top roll and bottom side roll permits independent movement of roll ends or the simultaneous adjustment of both ends of either roll. In this manner roll openings can be set precisely for the most accurate production to gauge.

This unique calender is an example of the made-to-order laboratory equipment—calenders, Banburys, mills, extruders, refiners, etc.—which you can obtain from Farrel-Birmingham. Send for information on machines to meet your specific needs.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
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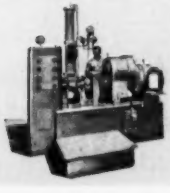
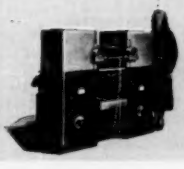
Farrel-Birmingham®

FB-730



This size B Banbury mixer, with a capacity of two pounds of crude natural rubber or gravity of batch times 2, can be conveniently and economically used in making trial batches. It is driven by a four-speed motor and is equipped with an exceptionally large air cylinder for forcing stock into the mixing chamber.



The two rolls of this 6" x 13" self-contained laboratory mill are individually driven, providing a considerable range of operating speeds and friction ratios. Speed range of the back roll is 3 to 48.9 RPM and the front roll from 4.6 to 36.8 RPM. The mill has tiltable guides, scrapers, knee-operated safety trip and cascade lubrication.

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(*Continued from page 208*)

MODERN PLASTICS

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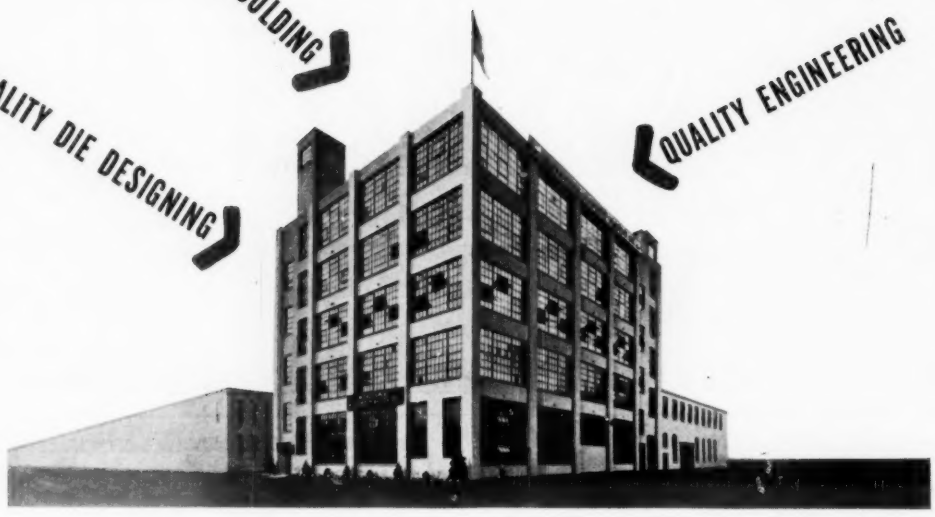
QUALITY DIE DESIGNING

QUALITY ENGINEERING



QUALITY DIE MAKING

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You can well afford to search the market for a custom injection moulder with leadership in moulding facilities and reputation for quality manufacture. Plastically speaking, we put a quality team of die designers, die makers, moulders, finishers and inspectors to work on your product regardless of its size or the quantity of your order. Because we manufacture no product under our own name, they concentrate solely on YOURS.

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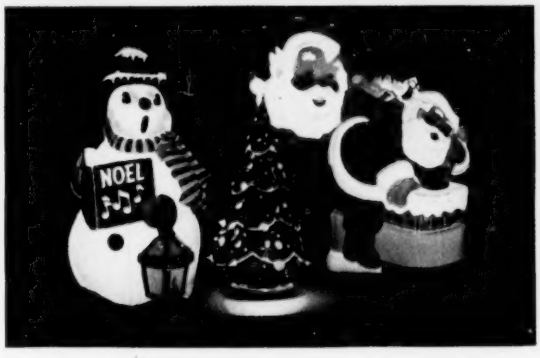

Lively, three-dimensional, gaily colored, illuminated—these displays by L. A. Goodman Mfg. Co., Chicago, Ill. are striking examples of the outstanding features of VINYLITE Brand Plastic Rigid Sheet — show how easy it is to work with this versatile material!

VINYLITE Rigid Sheets hold their shape, are light in weight, easily handled. Yet they're extremely durable — resist rough treatment, perspiration, chemicals, grease—won't crack, fray or fade. A damp cloth keeps them clean. Temperature and humidity changes won't affect them.

Transparent, translucent or opaque, VINYLITE Rigid Sheets can be printed flat in color—even take a realistic metallic finish like the plague. Then they're heat-formed to attractive shapes and details. Lamp shades, doll faces, drafting equipment, three-dimensional maps — scores of products in defense and industry are benefiting from the remarkable properties of these Rigid Sheets — the properties of VINYLITE Plastics and Resins. Get them for your products. For information and a list of suppliers, write Dept. NR-7.

Created and manufactured by the L. A. Goodman Mfg. Co., 131-145 West 63rd Street, Chicago 21, Illinois.

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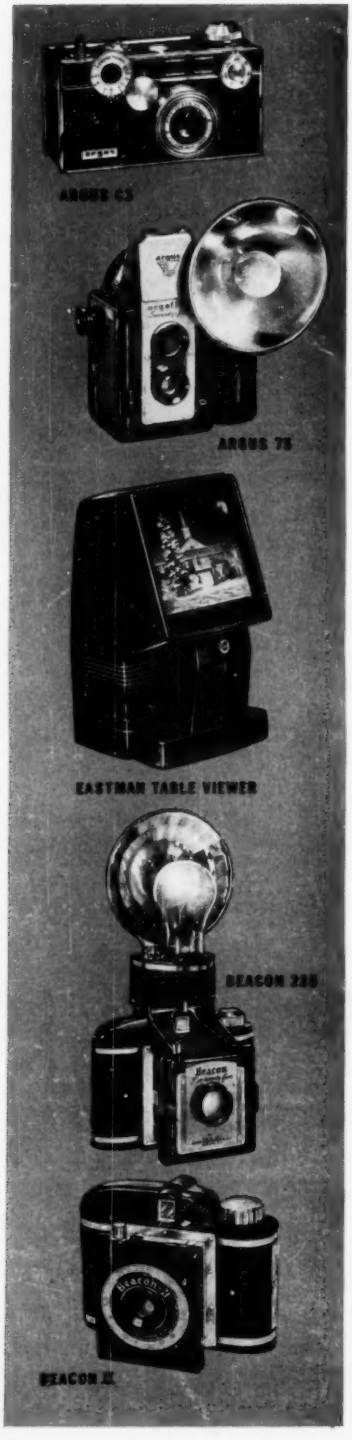

IDEAS IN PLASTICS FROM G.E.'s MOLDING SERVICE

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For products that click with the customers, depend on G-E plastics! The jobs shown here, molded by General Electric for some of America's leading camera manufacturers—and sold by the hundreds of thousands—tell the story. Smart-looking, compact, lightweight, these items illustrate how plastics can economically mass-produce the parts you need with the sales appeal you want.

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